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ERRATA

VOL. XLIV—Nos. 1 & 2.

I. *The Early Stages of Indian Lepidoptera—Pt. XI.*

Page 80, line 3, insert ' *Soc.*' after '*Hist.*'
,, line 10, *read* ' *Crocale* L.' *for* ' *Crocale* Cr.'
,, 82, line 25, *insert* ' 452 ' *after* '...Moths, v,'
,, 84, line 19, *read* ' *Boerhavia* ' *for* ' *Boerhaavia* '
,, 85, line 2, from bottom *read* ' somites ' *for* ' somite '. bottom line *read* ' spiracle ' *for* ' spiracles '
,, 86, line 39, *read* ' darker, pruinosed Spiracles ' *for* ' ...darker. Pruinosed spiracles.'

II. *Misc. Note XIX.—A Note on Fish Mortality in the Sohan River.*

Page 137, line 5, *for* ' p ' *read* ' pH '.
,, 9, *for* ' p ' *read* ' pH '.
,, 18, *for* ' p ' *read* ' pH '.

III. *A Few Notes about the Five Rhinoceros of the World.*

Page 258, line 6, from bottom of the page *for* ' 1936 ' *read* ' 1836 '.
,, 260, line 23, from bottom of the page *for* 'Peter Spicer or ' *read* ' Peter Spicer of '.
,, 261, line 18, from the bottom of the page, *for* ' Ah ' *read* ' At '.
,, 262, line 2, from the top of the page *for* ' Messrs. Hursh & Blackett.' *read* ' Messrs. Hurst & Blackett.'
,, 263, line 18, from the top of the page *for* the word ' needed ' *read* ' indeed '.
,, 265, line 3, from the bottom of the page *for* ' rebark ' *read* ' remark '.
,, 267, line 12, from the top of the page *for* ' Kyautpyu ' *read* ' Kyaukpyu '.
,, 272, line 2, from the bottom of the page *for* ' wisting ' *read* ' twisting '.
,, 274, line 14, from the top of the page *for* ' male ' *read* ' males '.

IV. *Misc. Note No. 1.—A Black Jungle Cat from Karachi and the Panther of Sind.*

Page 585, line 10, from the top of the page *for* ' sivler-fox ' *read* ' silver-fox '.
,, 590, line 4, from the bottom of the page *for* ' Mutjac ' *read* ' Muntjac '.
,, 591, line 3, from the top of the page *for* ' Bisson ' *read* ' Bison '.

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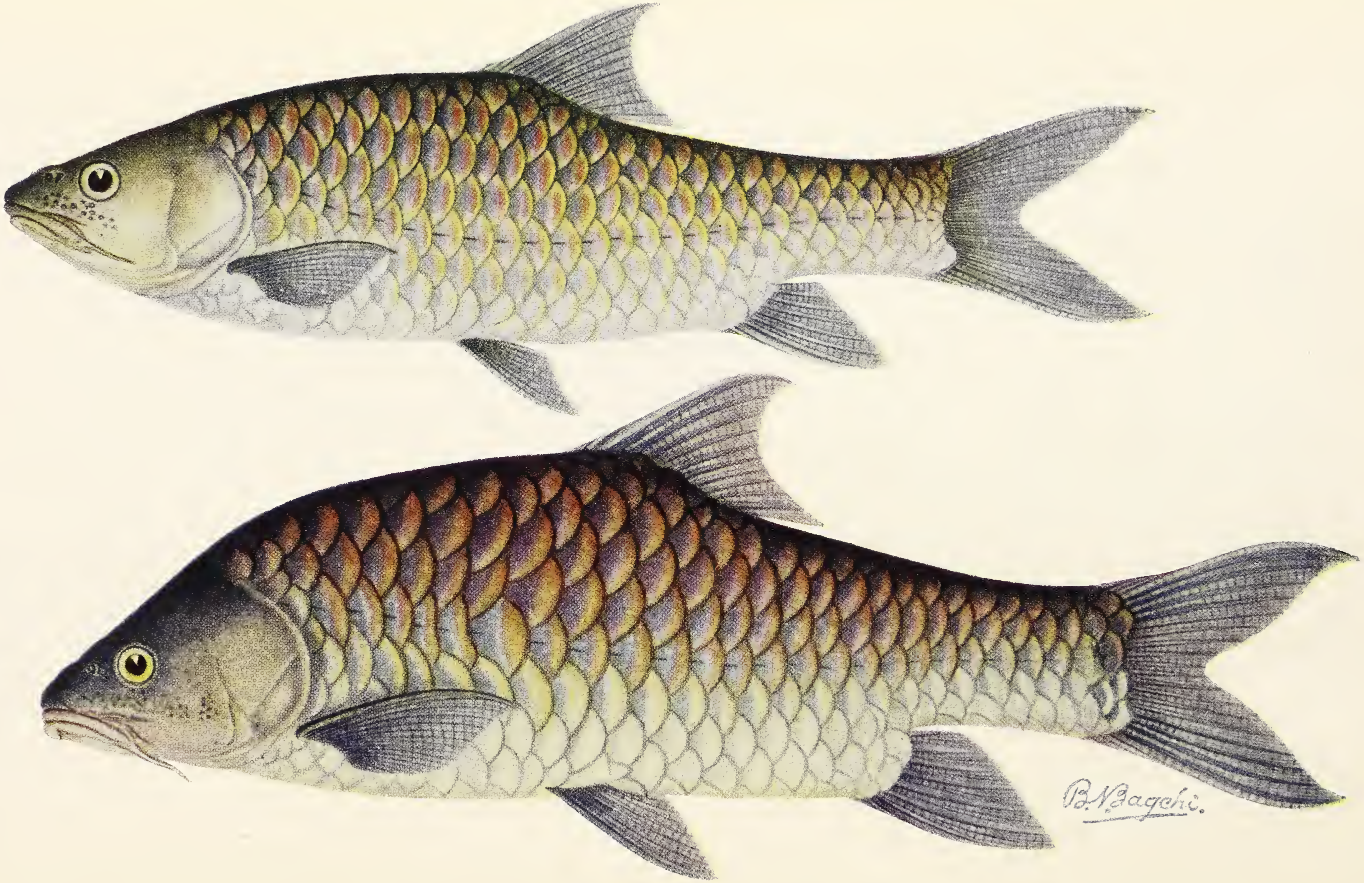
Two types of Mahseer from the Poona Waterways.



Upper : BARBUS (TOR) KHUDREE Sykes. *x ca* ½.
Lower : BARBUS (TOR) MUSSULLAH Sykes. *x ca* ¼.

The drawings were made from specimens and colour sketches supplied by Dr. M. Suter.

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THE GAME FISHES OF INDIA.

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.,
Director of Fisheries, Bengal.

(*With one coloured plate and three text-figures.*)

(*Continued from page* 169 *of Vol.* xliii, *No.* 2)

XVI.—THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

9. FURTHER OBSERVATIONS ON MAHSEERS FROM THE DECCAN.

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INTRODUCTION.

In the last article of this series (4)[1], attention was directed to the specific identity of Sykes's three species of *Barbus* from the Deccan, and it was shown that while *B. kolus* and *B. khudree* could be recognised as valid, doubts still existed about the identity of

---

[1] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

DEC 1 '43

B. mussullah. From the evidence then available, it seemed possible that *B. mussullah* might be the same fish which Hamilton (3) had previously described from Mysore as *B. curmuca* and which was later recorded from the Deccan also. However, a detailed consideration of the systematic position of this species was deferred till Dr. M. Suter had an occasion to carry out further investigations at Sirur, the type-locality of *B. mussullah.* He has now completed his studies and favoured me with the following report in his letter dated December 8, 1942. He writes :—

'I have now been to Sirur, Sykes's type-locality for his *Barbus mussullah* mainly in order to ascertain as definitely as possible whether *Barbus curmuca* occurs in the Ghod river and whether it is known to the local fishermen.

'The information elicited on hand of a preserved specimen and with the help of the excellent coloured picture from the pamphlet of the *Bombay Nat. Hist. Society* "Game Fishes of Bombay" proved entirely negative, i.e., neither the specimens nor the illustration were recognised as representing a fish of local occurrence, or at all known to local fishermen. A resemblance to *B. kolus* was indeed remarked upon and I was asked whether this (*B. kolus*) was the fish I wanted to know about.

'As you relate in your article in the August number of B. N. H. Society's *Journal*, the same men, on a former occasion, picked a picture of *B. curmuca* (out of the illustrated volume of Day's *Fishes of India*) as representing "*mussullah*" but, when later on they showed me a catch of very large high-backed mahseer, they assured me that this was "*mussullah*" and admitted that their identification of Day's picture had been an error caused mainly by the fact that they thought the shape of the head in the picture seemed to them a good likeness of the head of "*mussullah*", being somewhat "roman nosed".

'They also criticised Sykes's drawing of "*mussullah*" as being correct for the head, but wrong for the body, the scales being too small and too many.

'The position is now as follows :

1. *Barbus curmuca* is not known to the professional fishermen at Sykes's type-locality for *B. mussullah.*

2. The sturdy and high-backed species of mahseer of the Deccan is the only fish known to these men by the name of "*mussullah*" and most of the men differentiate it clearly from the slenderer species of mahseer (*Barbus khudree* Sykes).

3. Sykes expressly relates having been given a specimen of "*mussullah*" weighing 42 lbs. at Sirur, and the local fishermen repeatedly stated to me that the high-backed mahseer was the only fish with large scales known to them, whichever reached such a size or exceeded it.

The only other big fish with prominent scales known to the men are, *B. khudree, B. dobsoni* (=*jerdoni*), *Labeo calbasu, L. porcellus,* and *L. fimbriatus.*

4. The designation "*mussullah*" is also used by the fishermen of the Bhima and Idrayani rivers for large mahseer only, and many of the men use it for the high-backed species only, expressly differentiating it from the slenderer *B. khudree* Sykes, for which they have other designation, such as *khudchee, barsa,* etc.

Others, whilst quite aware of the difference between the two types of mahseer, will apply the name of "*mussullah*" to larger specimens of both types. The more observant ones, however, will not do so.

'Faced by the above result of my investigations at Sykes's locality I cannot but arrive at the conclusion, that the fish to which Sykes applied the name of *B. mussullah,* was none other than the stockily-built and high-backed mahseer of the Deccan.

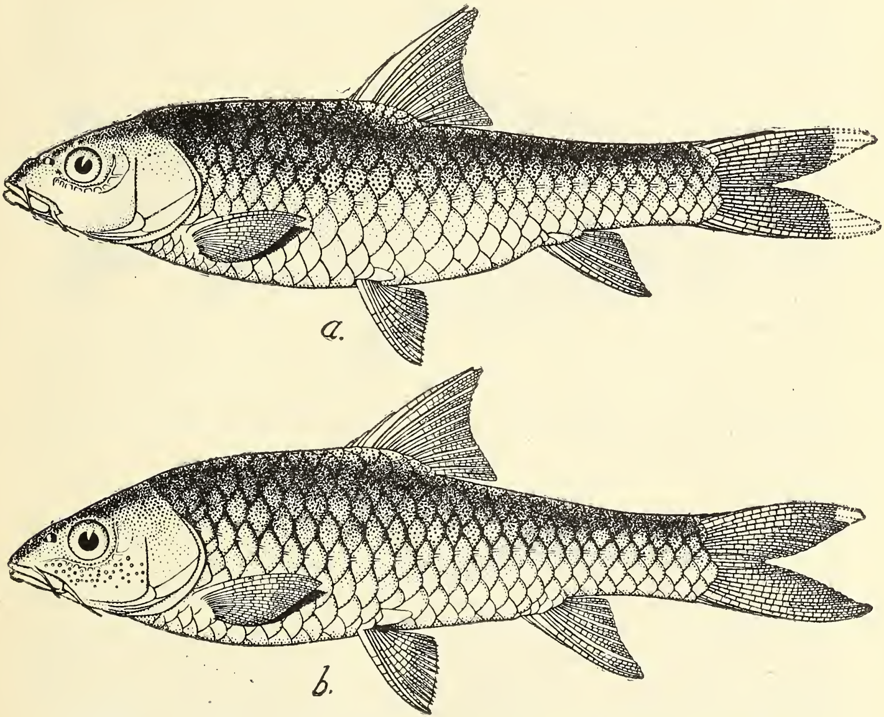
'The uncertainty prevailing for so long in respect of the identity of Sykes's species was caused by his incomplete description in respect of scale counts, and by the undoubted incorrectness of the drawing prepared by his employee, in which the scales were filled in haphazardly without any count having been taken.

'I have no doubt that you will arrive at the same conclusion and that thereby, the question will have arrived at its final elucidation.'

All ichthyologists and lovers of sport will ever remain grateful to Dr. M. Suter for the great trouble taken by him in elucidating the taxonomic position of Sykes's *B. mussullah* as there seems no doubt now that in describing this fish he intended to portray the high-backed mahseer of the Deccan waters. The difference in form between the two species of Deccan mahseers is clearly shown in the drawings on the coloured plate.

Dr. Suter has found both species of the Deccan mahseer pretty foul feeders at times. During the rains, he found them at such unsavoury spots as the place of discharge of surplus municipal sewage and has repeatedly seen them consume fresh buffalo dung.

Though the young of the various kinds of mahseer generally look alike, and the differences pointed out by Annandale (1) between the two species of Deccan mahseer are not very distinctive, it is quite possible that his *musundi* of the Upper Kistna may represent *Barbus mussullah* and his *B. tor,* locally known as *Kudis,* may be *B. khudree.* To facilitate reference in future, I give here drawings of Annandale's young specimens of the two species.



Text-fig. 1.—Lateral views of young specimens of Annandale's two species of Mahseer from the Deccan.

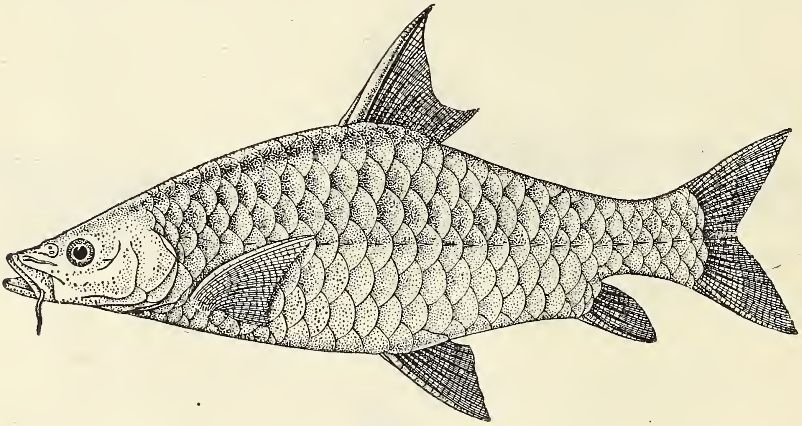
(*a*) *Barbus tor* (Hamilton), known near Satara as *Kudis.* × *ca.* 4/7. This is probably a young of *B. khudree* Sykes.

(*b*) *Barbus mussullah* Sykes, known near Satara as *Masundi.* × *ca.* 4/7.

The remarkable shape of Sykes's *B. mussullah* did attract the attention of later ichthyologists, but owing to his defective description and figure they could not identify it correctly. For instance, in recording *Barbus megalepis* McClelland from South India, Jerdon (**5**) stated:—

> 'I obtained a single small specimen of what I consider may be this fish in the Cauvery at Seringapatam. It was only a few inches long, but the fishermen, who call it *Kilche*, said it grew to an enormous size.'

The fish that grows to an enormous size in the Cauvery and its tributary streams, such as the Bhavani River, is figured and described by Thomas (**6**, pp. 22, 23) under the composite name *Barbus tor* in accordance with Day's (**2**, p. 573) nomenclature, though he seemed to have been aware of the fact that 'there are more Mahseers than have been named'. Thomas called it 'The Bawanny Mahseer' and noted that it is much deeper and more high backed than the other Mahseers. From his figure, reproduced here, it can be seen that the fish is pointed towards both ends. According to Thomas, it has a rich golden hue which shines on the gill-cover and forms predominant colour of every scale. It is known as 'Bom-min'.



Text-fig. 2.—The Bawanny Mahseer of Thomas (Reproduced from *Rod in India*).

Some years ago, Mr. S. H. Prater of the Bombay Natural History Society sent me a colour sketch of a baby Mahseer, 16½ inches long and 1½ lbs. in weight, caught by Messrs Van Ingen and Van Ingen of Mysore in the Bhavani River. The local name of the fish was given as *Kargolchi*. Though the colouration of this specimen, as shown in the sketch, is different from that of the Poona examples of *B. mussullah*, there seems hardly any doubt about its identity. It would thus appear that Sykes's *mussullah* is fairly widely distributed in the rivers of the Western Ghats. This remarkable mahseer may be redescribed as follows:—

Barbus (Tor) mussullah Sykes.

1838. *Barbus mussullah*, Sykes, *Proc. Zool. Soc. London*, p. 159.
1840. *Barbus mussullah*, Sykes, *Ann. Mag. Nat. Hist.*, IV, p. 56.
1841. *Barbus mussullah*, Sykes, *Trans. Zool. Soc., London*, II, p. 356.
1849. *Barbus megalepis*, Jerdon (*nec* McClelland), *Madras Journ. Litt. & Sci.* XV, p. 311.
1897. The Bawanny Mahseer, Thomas, *Rod in India*, 3rd Edition, pp. 22, 23.

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Whereas the Khudree Mahseer corresponds with the Mosal Mahseer of the Himalayan waters, Mussullah is similar in certain respects to the Tor Mahseer. In the Tor Mahseer, however, the head is always smooth, while in Sykes's species there are series of small tubercles, sometimes indistinct, on the sides below the eyes. The head is considerably shorter than the depth of the body, more particularly in older individuals, and the general build is stocky and heavy. The form is more or less spindle-shaped as both the profiles are considerably arched; the dorsal profile rises considerably from the tip of the snout to the base of the dorsal fin and then sharply slopes down to the base of the caudal fin. The ventral profile is comparatively gently arched. The head is pointed anteriorly; in mature specimens its length is contained about 5 times in the total length and 4 times in the length without the caudal. The depth of the body is contained from 3½ to 3¾ times in the total length and little over 3 times in the length without the caudal. The eye is small and is situated in the anterior half of the head; its diameter is contained about 6 times in the length of the head. The mouth is small and slightly slanting; the maxillary barbels are longer than the rostrals. The relative proportions of different parts vary considerably with age as can be readily made out from the table of measurements. The dorsal fin is situated in the middle of the back and possesses a strong, bony dorsal spine. All the fins are more or less pointed. The scales are large and well set; there are about 26-27 scales along the lateral line and 3½ rows below it to the base of the pelvic fin.

The colouration varies considerably. The young ones are rather silvery on the sides with pink reflexes, a creamy belly and slaty back and fins. In some large specimens the colour is very dark with bronzy reflexes. The bases of the scales below the lateral line are bluish gray while their margins are creamy. Generally the ventral surface is reddish cream. The dorsal surface is dark bronze. The bases of the scales in the upper half are mauvish gray while the bodies are reddish bronze with darker margin. The fin rays of the dorsal and caudal fins are reddish gray, while the interspinous membranes are bluish gray. The other fins are reddish gray, and all the fins are shot with bright blue streaks which are very prominent in the caudal.

The colours are more golden and reddish orange in the specimens from the Bhavani River. It would thus appear that whereas the predominant colour of the two Mahseers of the Deccan is bluish in the Poona waterways, it is reddish in the specimens found in the Cauvery and Bhavani Rivers much further south.

TABLE OF MEASUREMENTS.

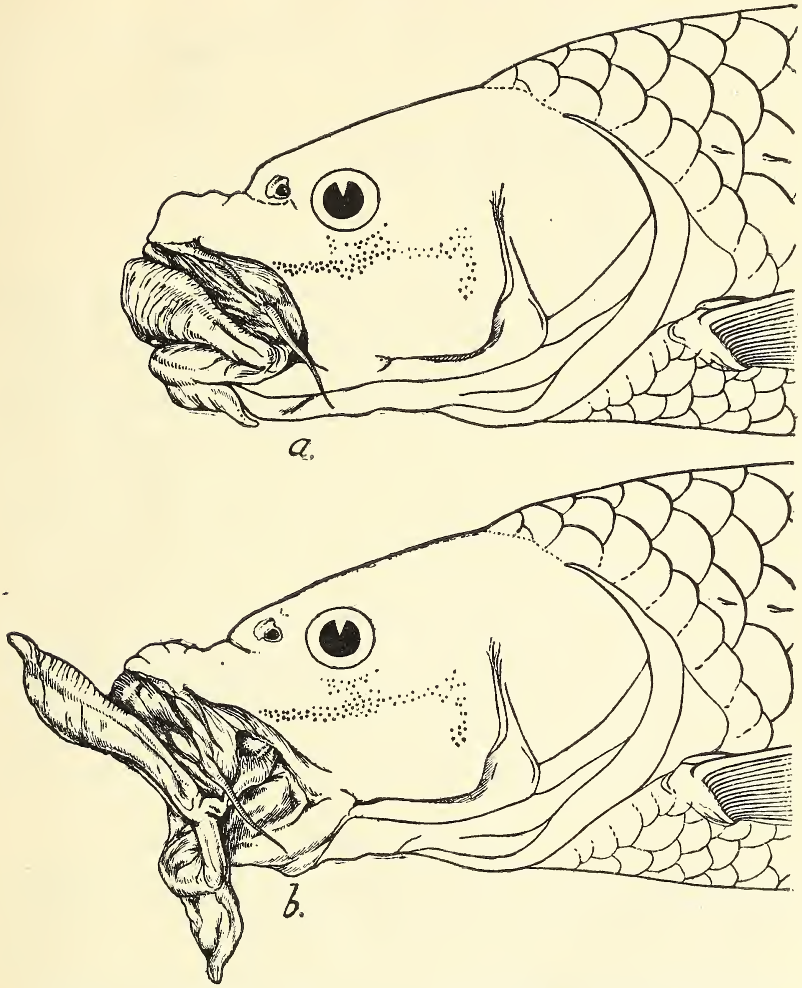
Measurements in millimetres and scale counts of Barbus (Tor) mussullah *Sykes*

Total length	148·0	270·0	275·0	622·0	750·0
Standard length	115·0	215·0	225·0	494·0	600·0
Length of head	33·0	58·0	60·0	125·0	149·0
Width of head	17·0	32·0	35·5	85·0	102·0
Diameter of eye	8·0	9·0	10·5	17·0	28·0
Length of snout	10·0	21·0	22·0	46·0	45·5
Interorbital distance ...	10·0	23·0	22·0	51·0	61·0
Width of body	16·0	35·0	Eviscerated		71·0
Depth of body	38·0	73·0	81·5	166·0	231·0
Length of caudal peduncle ...	16·0	35·0	33·0	91·0	106·0
Least height of caudal peduncle	15·0	29·5	30·0	63·0	82·0
Length of dorsal fin ...	29·0	52·0	52·0	99·0	120·0
Length of pectoral fin ...	23·0	43·0	42·0	96·0	125·0
Length of pelvic fin ...	21·0	39·0	38·0	88·0	104·0
Length of anal fin ...	25·0	44·0	45·0	95·0	109·0
Length of rostral barbel ...	6·5	12·0	12·0	27·0	30·0
Length of maxillary barbel ...	9·0	15·0	16·0	37·0	42·0
No. of predorsal scales ...	10	10	10	10	11
No. of scales along L. 1. ...	26	26	26	27	27
No. of scales between L. 1 and V.	3½	3½	3½	3½	3½
Scales round caudal peduncle.	13	12	13	12	12

Barbus (Tor) khudree Sykes.

In the preceding article of this series (4), it was stated that the sketches and specimens of *B. khudree* received from Dr. Suter would be dealt with later, but the transfer of the Zoological Survey of India to Benares for the duration of the war has made it impossible for me to comment in detail on them. It can, however, be stated with certainty that the material is similar to that collected by Dr. Fraser at Deolali and Poona.

A female mahseer, 5½ lbs. in weight, taken by Dr. Rishworth on the 20th December, 1942, in the Uhlas, a small river about 40 miles north of Bombay flowing into the Arabian Sea from the western slopes of the Ghats, has been identified as *B. khudree*. It is one of the few specimens of mahseer which have been collected from the cis-Ghat area and is characterized by greatly hypertrophied lips. The accompanying sketches show the lips and mouth protruded and closed. The colour of the specimen was similar to that found in the Deccan examples of this species, but the fins were tipped with



Text-fig. 3.—Head and anterior part of body of *Barbus* (*Tor*) *khudree* Sykes, showing hypertrophied lips. The specimen was collected by Dr. Rishworth in the Uhlas River, 40 miles north of Bombay. × ½.

(*a*) Lips and mouth closed; (*b*) Lips and mouth protruded.

In the fresh condition, Dr. Rishworth found that the lips could be extended much further than shown in the drawings made from preserved specimens.

yellowish pink. Its stomach contained green vegetable matter. The following further particulars about this specimen were supplied by Dr. Rishworth:—

Measurements in inches and number of fin rays.

Total length	25·0
Standard length	20·0
Length of head	6·25
Depth of body	5·5
Height of caudal peduncle	2·25
Girth of caudal peduncle	5·25
Dorsal	9
Anal	7
Pelvic	15
Ventral	9

From the observations on the colouration of the species made by Dr. Suter, it appears that in the Poona Waterways the colour is silvery bluish gray below the median line and almost creamy yellowish white on the ventral surface. The colour is darker above the lateral line, the bases of the scales being gray and their margin reddish gray. The colour of the back is dark olive. The head is dark olive above and creamy yellowish white below. The fins are bluish gray. The colour drawing of *B. khudree* reproduced here shows the general colouration of the species in the Poona Waterways as noted by Dr. Suter. Living fish as seen in clear water look reddish bronze in the back.

Acknowledgments.

I am indebted to Dr. M. Suter for specimens, colour sketches and observations on the Mahseers of the Deccan, and to the authorities of the Bombay Natural History Society for bearing the entire cost of the illustrations. I am also thankful to Babu B. Bagchi for the skill and care with which he prepared the illustrations under my supervision.

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Explanation of Plate.

Two types of Mahseer from the Poona Waterways.

Upper: *Barbus* (*Tor*) *khudree* Sykes. × *ca.* ½.
Lower: *Barbus* (*Tor*) *mussullah* Sykes. × *ca.* ¼.

The drawings were made from specimens and colour sketches supplied by Dr. M. Suter.

THE BIRDS OF MYSORE.

BY

SÁLIM ALI.

With notes by Hugh Whistler.

PART IV.

(*Continued from Vol.* xliii, *No.* 4, *p.* 595).

Hierococcyx sparverioides (Vigors). The Large Hawk-Cuckoo.

Specimens collected : *Biligirirangans* : M9(H) ♂ 10-3-34, M48(G) ♂ 29-10-34 (5,000′—Honnametti).

Not met with by the Survey.

[Measurements :

	Bill	Wing	Tail
1 ♂ ad.	30	224	— mm.
1 ♂ imm.	29	223	— mm.—H. W.]

Status? Evidently rare.

Hierococcyx varius Vahl. The Common Hawk-Cuckoo.

Specimens collected : 162 ♂ 24-11-39 Maddūr (2,500′); 184 ♂ 28-11-39 Antarsāntē (2,500′); 263 ♂ 4-12-39 Karāpūr (2,500′); 460 ♀ 26-12-39 Dodballapūr (2,900′); 641 ♂ 15-1-40 Saklēshpūr (3,000′); 682 ♀ 20-1-40 Bābābūdan Hills (5,000′—Kemmangūndi). *Biligirirangan Hills* : ♂ 21-12-32, M37(H) ♂ 5-4-34 (4,000′-5,000′—Honnametti).

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
3 ♂♂ ad.	25-28	193-199	168 mm.
1 ♀ ad.	—	194	156 mm.
3 ♂♂ imm.	25-27.5	183-189	160-161 mm.
1 ♀ imm.	28	188	(missing)—H. W.]

Evidently resident. Not common but frequent. Met with singly in both deciduous and evergreen biotopes and throughout the intermediate zone. Between November and March the birds were silent and no '*Brain-fever*' calls were heard.

Cacomantis merulinus passerinus (Vahl.). The Plaintive Cuckoo.

Specimens collected : 383 ♀ (hepatic) 19-12-39 Māklidrūg (2,800′—Bangalore Dist.).

Elsewhere noted : Settihālli. (This or *Penthoceryx sonnerati?* Unconfirmed).

[Measurements : 1 ♀ Bill 22, Wing 118, Tail 105.5 mm.

This is an adult female of the 'hepatic type.' It is moulting the wings and body, and it is important to note that it is moulting from 'hepatic' to 'hepatic' plumage.—H. W.]

Status? The specimen was a solitary in dry, deciduous, broken scrub-and-bush country.

Clamator jacobinus jacobinus (Bodd.). The Pied Crested Cuckoo.

Specimens collected : 91 ♂ 17-11-39 Bandipūr (3,300′); 298 ♀ 8-12-39 (2,000′—Seringapatām).

Elsewhere noted : Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
1 ♂	25	148	160 (worn) mm.
1 ♀	26.5	137.5	164 mm.

No. 91 ♂ is slightly larger than any other male of this race which I have examined. (Wing 138.5-146), but I think there is no doubt that it belongs to this race as there is no authentic record of the larger race below Bombay and the Central Provinces.—H. W.]

Status? Met with in deciduous biotope—lightly wooded country about villages and cultivation.

No. 91 was excessively fat, a circumstance which—in view of Mr. Whistler's remarks above—suggests that it *may* possibly belong to the northern race *pica* (believed to winter in Africa) preparing, rather late, for emigration.

Eudynamis scolopaceus scolopaceus (Linn.). The Koel.

Specimens collected: 96 o? 18-11-39, 158 ♂ 24-11-39 Bandipūr (3,300'); 244 ♀ 3-12-39 Antarsāntē (2,500'); 506 ♂ 29-12-39 Thōndēbhāvi (2,500'); 635 ♂ 15-1-40 Saklēshpūr (3,000'); *Biligirirangan Hills*: M14(G) ♂ 15-9-34, M28(G) ♀ 21-9-34, M49(G) ♀ 25-9-34 (2,000'—Satyamangala).

Elsewhere noted: Nāmadachilumē (3,000'—Tūmkūr Dist.).

[Measurements :

	Bill	Wing	Tail
4 ♂♂ ad.	30-33.5	188-202	177.5-195 mm.
3 ♀♀ ad.	30-34	192-203	192-193 mm.
1 ♀ juv.	—	188	188 mm.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects lightly wooded country about villages and cultivation with large leafy green trees as of banyan and tamarind, interspersed.

No. 96 (18 November) was very fat. Major Phythian-Adams has an egg taken from a crow's nest at Gūndlūpet, 25-8-1929.

Rhopodytes viridirostris (Jerdon). The Small Green-billed Malkoha.

Specimens collected: 93 ♂, 94 ♂ 18-11-39 Bandipūr (3,300'); 228 ♂ 1-12-39 Antarsāntē (2,500'); 345 ♀ 15-12-39 Sātnūr (2,500'); *Biligirirangan Hills*: M40(H) ♂ 5-4-34 (4,000'—Honnametti); M12(G) ♀ 8-8-34, M21(G) ♀ 10-7-34, M60(G) ♂ 19-7-34 (3,000'—Ūdahatti, Eastern base).

Elsewhere noted: Jōgimaradi (3,400'—Chitaldrūg town environs); Hiriyūr.

[Measurements :

	Bill	Wing	Tail
4 ♂♂	29-31.5	131-143	202-246 mm.
3 ♀♀	28-32.5	131-135	220-225 mm.
1 ♂ juv.	29.5	133	213 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects thin secondary, and scrub-and-bush jungle.

The ovary of No. 345 (15 December) was maturing; largest follicle over 2 mm. Major Phythian-Adams has a c/2 taken near Gūndlūpet, 12-6-1935.

Taccocua leschenaultii subsp. The Sirkeer Cuckoo.

No specimen.

Noted: Sātnūr. A pair in deciduous heavily thorn-scrubbed ravine, 15-12-39.

Centropus sinensis parroti Stres. The Southern Crow-Pheasant.

Specimens collected: 194 ♀ 29-11-39 Antarsāntē (2,500'); 562 ♂ 8-1-40 Marikānivē (2,500'). *Biligirirangan Hills*: M2(H) ♀ juv. 7-5-34, M76(M) ♀ 16-5-34 (4,000-5,000'—Bellāji).

Elsewhere noted: Edbūthi (Biligiris), Bandipūr, Nāmadachilumē, Settihālli.

[Measurements :

	Bill	Wing	Tail
2 ♀♀ ad.	38-42	180-203	247-260 mm.
1 ♂ juv.	38.5	181	248 mm.
1 ♀ juv.	35	170	184 mm.

Both these juveniles are exactly like the adults in colouration whereas most if not all adults of *C. sinensis sinensis* in N.-W. India have a conspicuously different barred plumage. It will probably prove to be a racial characteristic. —H. W.]

Resident. Not common; occasional solos. Confined to deciduous biotope. Affects lightly wooded and scrub-and-bush country, usually about cultivation.

No. 562 was infested with the cestodes *Railiettina (Skrjabinia) centropi* (Southwell, 1922) in the body cavity (or intestine?).

Psittacula eupatria subsp. The Alexandrine Parakeet.

No specimens.

Noted: Settihālli (— A flock of 8 in teak and bamboo forest on 27 January, and again a small flock on 2 February); Kolār Gold Fields (Solo, 21-2-40).

Psittacula krameri manillensis Bechst. The Rose-ringed Parakeet.

Specimens collected: 438 ♂ 24-12-39 Dodballapūr (2,900′); 511 ♂ 31-12-39 Nāmadachilumē (3,000′).

Elsewhere noted: Heggadedavankotē, Karāpūr, Kolār Gold Fields.

[Measurements: 2 ♂♂ Bill from cere 23-25, Wing 167-172, Tail 218-238 mm.

It is interesting to note that from the size of the organs (testes 12×6 and 12×5 mm.) both these males were about to breed in immature and female-like dress—H. W.]

Resident. Not common. Confined to deciduous biotope. Found in fairly wooded country, usually around cultivation.

The specimens, with testes 12×6 and 12×5 mm. respectively were either breeding or about to breed.

Psittacula cyanocephala cyanocephala (Linn.). The Western Blossom-headed Parakeet.

Specimens collected: 114 ♀ 19-11-39 Bandipūr (3,300′); 538 ♂ 4-1-40 Nāmadachilumē (3,000′); *Biligirirangan Hills*: 20 ♂ 8-11-39 (3,500′—Bedagūli); M17(G) ♀ 10-7-34 M111(G) ♂ 3-8-34 (3,000′—Ūdahatti, E. base).

Elsewhere noted: Devarbetta Hill, Jāgar Valley (Bābābūdans), Settihālli.

[Measurements:

	Bill (from cere)	Wing	Tail
2 ♂♂ ad.	18-19	138-142	191-215 mm.
1 ♀ ad.	17	132	—
1 ♀ imm	16	133	— —H. W.]

Resident. Fairly common. Confined to deciduous biotope, but it also extends far into the intermediate zone. In the Biligirirangans it was a noticeable feature that this species occurred in the deciduous and semi-evergreen forest (in the last coincident with *columboides*) up to about 3,500 ft. elevation, but that it was entirely replaced by *columboides* higher up as the vegetation took on an increasingly evergreen aspect.

Along with the next species this parakeet is very destructive to crops of jowāri and the vetch *Dolichos lablab* (Linn.) (Canarese: *aorē-khāi*)[1] cultivated in forest clearings.

In specimen No. 538 (4 January) the testes measured 6×4 mm. and were evidently maturing.

Psittacula columboides (Vigors). The Blue-winged Parakeet.

Specimens collected: 350 ♂ 15-12-39 Devarbetta Hill (3,000′); 611 ♂ 13-1-40 Saklēshpūr (3,000′); 769 ♀ 29-1-40 Settihālli (2,500′); 849 ♂ 8-2-40 Āgūmbē (2,500′). *Biligirirangan Hills*: 34 ♂ 10-11-39 (4,000′—Bedagūli); ♂ 18-12-32, M11(H) ♂ 16-3-34, M17(H) ♂ 24-2-34, M61(H) ♂ 24-4-34,

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[1] The Forest Guard when asked whether this was used as food explained that 'it is only used for putting into bag and tying to nose of horse'!

M13-14(H) ♂♂ 8-5-34, M40-41 ♀o? 11-5-34 (4,000-5,000′ Honnametti); M82 (H) ♂ 18-5-34 (5,000′—Bellāji); M36(G) ♂ 14-7-34 (3,000′—Ūdahatti, Eastern base).

Elsewhere noted: Bandipūr, Antarsāntē, Karāpūr, Bābābūdan Hills (Jāgar Valley 2,500′; Kemmangūndi 4,500′).

[Measurements :

	Bill (from cere)	Wing	Tail
9 ♂♂ ad.	22.5-24	143.5-156	204.5-246 mm.
1 ♀ ad.	23	144.5	167 mm.
4 ♂♂ juv.	21.5-23	140.5-152	148-164 mm.
1 ♀ juv.	20	143.5	163 mm.

This species has not been recorded before so far east as the Biligirirangan Hills and Devarbetta Hill.—H. W.]

Resident. Common. Confined to evergreen biotope, but freely entering the intermediate zone to about the same limit as *cyanocephala* does from the deciduous end. The distribution of the 2 species overlaps at its seam.

It is the only parakeet found in the coffee estates and may invariably be seen eating the nectar from the *Grevillea* and *Erythrina* flowers of the shade trees planted here.

This species, prized by fanciers as the 'Bābābūdan Parrot' has acquired an almost universal reputation in Mysore State (and doubtless beyond) as a talking paragon. It is accredited with being an exceptional linguist and believed to address human beings in Arabic! The foundation for this widespread belief appears to be that one Bābūddin, a pilgrim from Mecca (and incidentally the originator of coffee-planting in South India) who settled on the hills that now bear a semblance of his name (Bābābūdan), kept a local parakeet (or several parakeets?) whom he taught to call to Allah and recite verses from the Koran. Whether some of his trained parrots escaped or were artfully released after completing their novitiate is not clear. But they were regularly fed and so kept near the abode of this holy man. To his glorification they caused open-mouthed wonderment amongst the devout who pilgrimaged to the saint periodically and who helped afterwards to broadcast the magical piety of Bābūddin and the spell it had cast upon the parakeets of the locality.

Coryllis vernalis (Sparrm.). The Indian Loriquet.

Specimens collected: 113 ♀ 19-11-39 Bandipūr (3,300′); 250 ♂ 3-12-39 Karāpūr (2,500′); 643 ♀ 16-1-40 Saklēshpūr (3,000′); 687 ♂ 20-1-40 Bābābūdan Hills (Jāgar Valley 2,500′); 791 ♂ 31-1-40 Settihālli (2,500′); 858 ♂ 11-2-39 Jōg (2,000′). *Biligirirangan Hills*: M55-56(G) ♂♀ 19-7-34, M91-92(G) ♂♂ 25-7-34 (3,000′—Ūdahatti, E. base).

Elsewhere noted: Bedagūli (3,500′ Biligiris); Antarsāntē, Āgūmbē.

[Measurements :

	Bill (from cere)	Wing	Tail
5 ♂♂	11-12	91-96	38.5-43.5 mm.
2 ♀♀	11	96.5-99.5	45-47 mm.

In the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxvii, 754) I expressed my hesitation at keeping up the race *rubropygialis* for birds of the southern distribution of this species. The examination of this series and some new skins from Assam has satisfied me that the race cannot be maintained. The supposed differences on which it is based do not appear to hold good, being either individual or due to wear.—H. W.]

Resident. Common. Essentially an inhabitant of the intermediate zone, but wandering a good way into either extreme as prospects of food tempt it.

The specimens of 20 and 31 January and 11 February had mature testes: 6×4 (2), 5×3 (1) mm.

Coracias benghalensis indica Linn. The South Indian Roller.

Specimens collected: 333-335 ♂♂♀ 15-12-39 Sātnūr (2,500′); 459 ♂ 26-12-39 Dodballapūr (2,900′); 779 ♂ 30-1-40 Settihālli (2,500′). *Biligirirangan Hills*: M108(G) ♂ 1-8-34 (3,000′—Ūdahatti, E. base).

Elsewhere noted: Hūnsūr, Māndya, Nāmadachilumē, Kolār Gold Fields,

[Measurements :

	Bill	Wing	Tail
5 ♂♂	41-45	180-184	119-128.5 mm.
1 ♀	41.5	174	117 mm.—H. W.]

Resident. Not common and sparsely and patchily distributed. Confined to deciduous biotope. Frequents open, lightly wooded country and cultivated areas. Curiously enough not a single example was observed between 10 November and 5 December at Bandipūr, Antarsāntē, Mysore City environs, Kākenkotē or Karāpūr although appropriate facies were not wanting.

The noisy, aerial pre-nuptial display was first observed on 15 December (Sātnūr). Specimens 459 (26 January) and 779 (30 January) both had maturing testes—6×4 mm.

Major Phythian-Adams has a c/2 in his collection from Nanjangūd— -2-1930, and another c/2 Gūndlūpet 7-4-1938.

Merops orientalis orientalis Latham. The Common Indian Bee-eater.

Specimens collected : *Biligirirangan Hills* : 41 ♀ 10-11-39 (3,500′—Bedagūli); M26(G) ♀ 12-7-34, M87(G) ♂ 25-7-34 (3,000′—Ūdahatti, E. base).

Elsewhere noted : Bandipūr, Antarsāntē, Sātnūr, Marikānivē, Settihālli, Āgūmbē, Kolār Gold Fields, Mysore and Bangalore City environs.

[Measurements : 1 ♀ Bill 33, Wing 91.5, Tail 107 mm.

Both the July birds are in moult.—H. W.]

Resident. Common. Confined to deciduous biotope, extending partly through the dry-inter belt. Affects open scrub-and-bush and cultivated country. Also found in forest *taungya* clearings.

Merops superciliosus javanicus Horsf. The Blue-tailed Bee-eater.

Specimens collected : 819 ♂, 820 ♂ 4-2-40 Āgūmbē (2,500′).

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
1 ♂ ad.	46.5	135	130.5 mm.
1 ♂ juv.	44.5	127	85.5 mm.—H. W.]

Status? Apparently rare. The specimens were out of a small party seen near the Travellers' Bungalow in open village outskirts on the edge of evergreen forest.

Merops leschenaulti leschenaulti Vieillot. The Chestnut-headed Bee-eater.

Specimens collected : 326 ♀ 13-12-39 Shimsha (2,500′). *Biligirirangan Hills* : 30 ♀ 9-11-39 (4,000′—Edbūthi).

Elsewhere noted : Settihālli.

[Measurements : 2 ♀♀ Bill 38.5, Wing 106, Tail 80-80.5 mm.—H. W.]

Status? Uncommon; occurring sparingly and sporadically. Apparently confined to deciduous biotope, principally to the dry-inter belt, but extending in small numbers throughout the intermediate zone. Affects well wooded country.

Bucia athertoni (Jardine & Selby). The Blue-bearded Bee-eater.

Specimens collected : 309 ♂ 19-12-39 Hūnsūr (2,000′). *Biligirirangan Hills* : M16(G) ♀ 16-10-34 (5,000′—Honnametti); M39(G) ♀ 13-9-34, M43(G) ♀ 24-9-34 (2,000′—Satyamangala).

Elsewhere noted : Manchgowdanhalli, Nāmadachilumē.

[Measurements :

	Bill	Wing	Tail
1 ♂	50.5	143.5	137 mm.
2 ♀♀	50-57	138	128-137 mm.

One of the Biligiri specimens is in heavy moult hence not measured.—H. W.]

Resident. Uncommon and patchy. I believe this is really a bird of the dry-inter belt, but it wanders across into either of the terminal biotopes for some distance.

It affects fairly well-wooded country with a sprinkling of large trees.

Ceryle rudis subsp. The Pied Kingfisher.

No specimens.

Noted: Karāpūr (at tanks and Kabani river); Kolār Gold Fields (at Bētmangala tank and Pālār river). Not common.

Major Phythian-Adams has a c/8, Gūndlūpet, 20-1-1929.

Alcedo atthis taprobana Kleinschmidt. The Common Ceylon Kingfisher.

Specimens collected: 327 ♀ 13-12-39 Shimsha (2,900′); 558 ♀ 7-1-40 Marikānivē (2,500′); 654 ♀ 16-1-40 Saklēshpūr (3,000′); 844 ♂ 7-2-40 Āgūmbē (2,000′); *Biligirirangans*: M10(G) ♂ 8-8-34 (3,000′—Ūdahatti, E. base).

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	44	70	30·5
3 ♀♀	43-44·5	72·5-73	33-33·5 mm.

While these are not quite pure *taprobanus* they are certainly closer to that race than to *bengalenis*.—H. W.]

Resident. Not common. Seen singly on rivers and streams chiefly in deciduous biotope, but extending into the intermediate zone.

Ceyx erithaca erithaca (Linn.) The Indian Three-toed Kingfisher.

Specimen collected: 283 ♂ 6-12-39 Manchgowdanhalli (2,500′).

Elsewhere not noted.

[Measurements: 1 ♂ Bill 36, Wing 58, Tail 24.5 mm.

A very welcome record in view of my remarks in the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxii, 761) about the paucity of records for South India. Mr. C. G. Webb-Peploe kindly informs me that about 1936 he found one of these beautiful kingfishers dead in a stream bed at 2,000′ at Naraikkadu on the east slope of the Ashāmbū Hills in Travancore.—H. W.]

The specimen—the only met with in Mysore—was solitary in dense deciduous bamboo jungle on the banks of the Kabani river.

Ramphalcyon capensis [**gurial** (Pearson)]. The Brown-headed Stork-billed Kingfisher.

No specimens.

Noted: Manchgowdanhalli (deciduous biotope. On Kabani river); Settihālli.

Major Phythian-Adams has a c/3, Moyār river (Mysore-Nilgiris boundary) 31-3-38.

Halcyon smyrnensis smyrnensis (Linn.). The White-breasted Kingfisher.

Specimens collected: 341 ♂ 15-12-39 Sātnūr (2,500′); *Biligirirangan Hills*: M10(G) ♂ 15-9-34 (2,000′—Satyamangala), and another without precise data.

Elsewhere noted: Saklēshpūr, Settihālli.

[Measurements: 1 ♂ Bill 62.5, Wing 123.5, Tail 82 mm.

In size and colour I cannot separate this from the typical race. The two birds from the Biligirirangans, however, both in complete moult, are very dark and would seem to be *fusca*.—H. W.]

Resident. Not common. Confined to deciduous biotope. Frequents tanks and ponds as well as light secondary jungle.

Halcyon pileata (Bodd). The Black-capped Kingfisher.

No specimens.

A solitary example was observed on rocks in the 'cauldron' at the foot of Jōg (Gersoppa). Falls, 10-2-40.

Humayūn Abdulali (*J.B.N.H.S.*, xxxviii, 830) noted a solitary bird in this same spot in December 1935, as curiously enough did also Davidson exactly 42 years earlier! (*J.B.N.H.S.*, xii, 46).

Hydrocissa coronata (Bodd.). The Malabar Pied Hornbill.

No specimens.

A party of three was observed in deciduous forest with tall trees and bamboo at Manchgowdanhalli (near Antarsāntē) 3-12-39. This was the only meeting with the species in Mysore.

Tockus birostris (Scopoli). The Common Grey Hornbill.

Specimens collected: 321 ♀ 13-12-39 Sātnūr (2,500′). *Biligirirangans*: M3 (G) ♀ 14-9-34 (2,000′—Satyamangala).

Elsewhere noted: Maddūr, Gūndlūpet, Hiriyūr.

Resident. Common. Confined to deciduous biotope. Affects secondary jungle, and wooded country and groves about cultivation.

Tockus griseus (Latham). The Malabar Grey Hornbill.

Specimens collected: 642 ♀ 16-1-40 Saklēshpūr (3,000′); 675 ♂ 19-1-40 Bābābūdan Hills (4,500′—Kemmangūndi).

[Measurements :

	Bill from skull	Wing	Tail
1 ♂	100	205	210 mm.
1 ♀	84	195	204 mm.—H. W.]

Resident. Common. Confined to evergreen biotope, being the ecological counterpart here of the Common Grey Hornbill. Affects forest, especially where the various species of *Ficus* abound.

Upupa epops ceylonensis Reichenbach. The Ceylon Hoope.

Specimens collected: 101 ♀ 18-11-39, 155 ♀ 23-11-39 Bandipūr (2,800-3,300′); 399 ♂ 20-12-39, 472 ♂ 27-12-39 Dodballapūr (2,900′); *Biligirirangan Hills*: M49(H) ♂ 10-4-34 (5,000′—Honnametti); M2(G) ♂ 14-9-34 (2,000′—Satyamangala); M32(G) ♂ 14-7-34, M89(G) ♂ 25-7-34 (3,000′—Ūdahatti, E. base).

Elsewhere noted: Hiriyūr, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
6 ♂♂	52-61.5	120.5-143	83-98 mm.
2 ♀♀	51-55.5	127	84-88 mm.—H. W.]

Resident. Not common. Confined to deciduous biotope but extending in diminishing numbers through the intermediate zone up to its evergreen boundary. The December males had maturing testes: 7×4 and 5×3 respectively.

Harpactes fasciatus malabaricus (Gould). The Malabar Trogon.

Specimens collected: 612 ♀ 13-1-40 Saklēshpūr (3,000′); 741 ♀ 26-1-40, 767-768 ♂♀ 29-1-40, 788 ♂ 31-1-40 Settihālli (2,500′).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	20-20.5	123.5-128	156-162 mm.
3 ♀♀	20-21	122.5-127	162-167 mm.—H. W.]

Resident. Fairly common. Confined to evergreen biotope, extending across the moist-inter zone.

Micropus melba bakeri (Hartert). The Indian Alpine Swift.

Specimens collected: 532 ♀ 3-1-40 Devarāyadrūg (4,000′—Tūmkūr Dist.); 857 ♀ 11-2-40, 861-864 ♂♂♂♀ 12-2-40, also ♂♀ 25-12-35 (Humayun Abdulali), Jōg (2,000′—Sāgar Dist.). *Biligirirangan Hills*: o? 19-12-32 (5,000′—above Dodsampagi).

Elsewhere noted: Bandipūr, Nandidrūg.

[Measurements :

	Bill	Wing	C. tail	O. tail
4 ♂♂	14-16	204-212	59-62.5	74-77 mm.
5 ♀♀	14-15.5	200-206	58-61	72-76 mm.

A very useful contribution to the verification of this interesting race distinguished both by its small size and by its dark colouration.—H. W.]

Resident and local migrant. Not common. Usually seen in the hills hawking winged insects about and above fissured crags and rock scarps.

On the summit of Devārāyadrūg Hill I observed that the birds circled back and forth almost within gunshot before the sun had set, but that they steadily rose higher and higher after the sun went down. This was evidently due to the fact that their insect prey kept rising higher to remain in the warmth of the sunlight. The birds were usually seen flying about the hill until about 10-30 a.m. when some of them at least retired into the fissures of the rock (brooding?). Thereafter practically none were on the wing in this neighbourhood again before late afternoon, and they continued to feed till well after dusk high up in the heavens.

Several pairs were observed in copula on the wing, the male treading the female in mid-air. During the act both birds whirled round and round as one unit and fell slowly through space parachute-wise for about 100 feet or so on outstretched but motionless wings. They separated after this and flew off individually.

All the specimens had maturing or fully mature gonads, and breeding was undoubtedly in progress. Testes 9×4 to 14×6 mm.; ovaries markedly granular. The largest follicle in No. 532 (3 January) measured 4 mm. and its distended oviduct indicated that it had laid.

Humayun Abdulali collected breeding birds at Jōg, where the species is particularly numerous, on 26-12-35 (*J.B.N.H.S.*, xxxviii, p. 829). Strangely enough when Mr. C. McCann visited the Falls on 10 June (1938) he found these Swifts completely absent (*J.B.N.H.S.*, xli, p. 450). Where they go away during the S.-W. Monsoon still remains to be discovered. Humayun Abdulali tells me that the birds were absent from this locality on 3 August (1939), but some were back by 7 September when the place was revisited by him.

Micropus affinis [affinis (Gray)]. The Common Indian House-Swift.

No specimens.

Resident. Confined to deciduous biotope. Evidently not common. Small numbers of these swifts were observed about Vanivilās Dam at Marikānivē (9 January). Also about the old temples at Halēbid (12 January) wherein they were nesting and making a nuisance of themselves. Several disused nests were also seen in the former locality.

Chaetura giganteus indicus Hume. The Brown-throated Spinetail.

No specimens.

Noted: Maddūr (near Gūndlūpet), Saklēshpūr, Bābābūdan Hills (Jāgar Valley).

Presumably resident. Confined to evergreen biotope. Usually seen in loose flocks flying at terrific speed and hawking insects over grassy hilltops and forest clearings, especially where fired.

Indicapus sylvaticus (Blyth). The White-rumped Spinetail.

No specimens.

Noted: Saklēshpūr, Kādāmanē Estate, Settihālli.

Resident? Sporadic. Confined to evergreen biotope. Like the preceding species it is usually seen in loose 'flocks' hawking insects above grassy hilltops and forest clearings; frequently also in the intermediate zone.

Collocalia fuciphaga subsp. The Edible Swiftlet.

No specimens.

Noted: Karāpūr (Deciduous). A gathering of 30-50 birds hawking insects high above Kabani river, 3-12-39. Āgūmbē: (Evergreen. A few on 2-2-40!).

Hemiprocne coronata (Tickell). The Indian Crested Swift.

Specimens collected: 120 ♂, 121 ♂ 20-11-39 Bandipūr (3,300').

Elsewhere noted: Shimsha, Sivāsamūdram, Nāmadachilumē, Settihālli.

[Measurements: 2 ♂♂ Bills damaged. Wing 153-154, C. Tail 44, O. Tail 109.5-117 mm.—H. W.]

Resident. Not uncommon. Confined to deciduous biotope. Met with in secondary jungle and about forest clearings for cultivation.

Caprimulgus macrourus atripennis Jerdon. Jerdon's Long-tailed Nightjar.

Specimen collected: 147 ♂ 23-11-39 Bandipūr (3,300′).

[Measurements: 1 ♂ Bill 23.5, Wing 189, Tail 133 mm.—H. W.]

The specimen was hawking beetles at dusk on a motor road through deciduous and bamboo forest.

Caprimulgus indicus indicus Latham. The Indian Jungle Nightjar.

Specimens collected: 119 ♀ 20-11-39 Bandipūr (3,300′); 249 ♀ 3-12-39 Antarsāntē (2,500′); 627 ♂ 14-1-40 Saklēshpūr (3,000′); 747 ♂, 748 ♂ 27-1-40 Settihālli (2,500′). *Biligirirangan Hills*: M13(H) ♀, M16(H) ♂ 4-3-34 (5,000′—Honnametti).

[Measurements:

	Bill	Wing	Tail
4 ♂♂	20-23.5	192-198	129.5-137 mm.
4 ♀♀	23-24.5	190-195	129-131 mm.—H. W.]

Resident? Common. Confined to deciduous biotope; occasionally found in the dry-inter belt. Affects teak plantations and bamboo facies. Perches on branches both lengthwise and across. No. 627 was shot at 10 a.m. perched lengthwise asleep on a branch of a tall shade tree at edge of coffee plantation.

The call of this nightjar, commencing at dusk and continued far into and often throughout the night, (especially if moonlit) is *Krūk . . . krū-kroo* or *Uk . . . krū-kroo* repeated monotonously every 2 seconds or so for ¼ or even ½ hour at a stretch. Elsewhere I have recorded the call also as *Chuck-ko, chuck-ko* etc. about once every second.

Caprimulgus monticolus monticolus Franklin. Franklin's Nightjar.

Specimens collected: 134 ♀ 21-11-39 Gūdalūr Ghāt (3,000′—near Kākenhālla); 148 ♀ 23-11-39 Bandipūr (3,300′).

[Measurements: 2 ♀♀ Bill 19-20, Wing 187-190, Tail 108-113.5 mm.—H. W.]

Usually seen on roads through deciduous forest at dusk. No. 134 was perched on a telegraph wire (across).

Caprimulgus asiaticus asiaticus Latham. The Common Indian Nightjar.

Specimens collected: 231 ♂ 2-12-39 Antarsāntē (2,500′); *Biligirirangans*: M113(G) ♀ 4-8-34 (3,000′—Ūdahatti, E. base).

Elsewhere noted: Marikānivē.

[Measurements:

	Bill	Wing	Tail
1 ♂	19	143	— mm.
1 ♀	—	147	103 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects open sparse scrub-and-bush country and fallow land.

Testes of 2 December specimen 7×5 mm.

[**Asio flammeus flammeus** (Pontoppidan). The Short-eared Owl.

Specimens collected: 655-658 ♀♀♀♀ 17-1-40 Hebbālē, Coorg (2,500′).

[Measurements: 4 ♀♀ Bill 30-30.5, Wing 300-318, Tail 143.5-146 mm.—H. W.]

These specimens were obtained actually a few miles beyond the western boundary of Mysore State, but are included here since there seems no reason to doubt that the species also occurs within our area in the appropriate deciduous facies.

The birds were shot from a loose 'flock' of about 20 resting amongst scrub and grass covered stony hillocks. One was observed sunning itself, belly to ground and wings outstretched. On the wing, and seen from behind, the birds were reminiscent of a party of Houbara bustards.

At 3 o'clock in the afternoon, when shot, the stomachs of all the specimens were quite empty.]

Strix indranee indranee Sykes. The Brown Wood-Owl.

Specimens collected : 168 ♂ 25-11-39 Bandipūr (3,300′).
Elsewhere noted : Sātnūr.

[Measurements : 1 ♂ Bill 40, Wing 340, Tail 186 mm.—H. W.]

The specimen was one of a pair up in a dense bamboo clump in deciduous forest. Its stomach was empty at 7-30 a.m., when shot, but for a single live *Ascaris*-like nematode worm *Seuratum* sp., probably a 'pseudoparasite.' Testes 13×7 mm.

Strix ocellata (Lesson). The Mottled Wood-Owl.

Specimens collected : 135 ♀ 22-11-39 Bandipūr (2,800′—near Hangala village).
Elsewhere noted : Chamarājanagar, Gūndlūpet, Marikānivē.

[Measurements : 1 ♀ Bill 40.5, Wing 339, Tail 177 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects wooded country with large densely foliaged tamarind and similar trees around villages and cultivation. When flushed from its daytime retreat it can fly long distances in bright sunshine without apparent discomfort. As distinct from *Bubo,* this owl alights on the inside (more or less secluded) branches of a tree after a flight, and not on the outside or peripheral ones.

Bubo bubo bengalensis (Franklin). The Indian Great Horned Owl.

Specimens collected : 136 ♂ 22-11-39 Bandipūr (2,800′—near Hangala village); 537 ♂ 4-1-40 Nāmadachilumē (3,000′).

[Measurements : 2 ♂♂ Bill 44-47, Wing 364-374, Tail 190 mm.

These specimens are rather dark on the upper plumage, but I have already pointed out (*J.B.N.H.S.*, xxxviii, 234) that this species is very variable in colour and I do not think that northern and southern races should be separated.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects ravines and boulder hillocks in secondary forest and sparsely wooded country, as well as groves of large thickly foliaged trees in the neighbourhood of villages and cultivation.

The specimens were both either breeding or about to breed: testes 18×10 and 15×10 mm. Under the skin of the nape of No. 136 were found embedded several examples of the Nematode worm *Parhamatospiculum bubicola* Skrjabin & Petrow, 1935.

A local belief current about the large owls was narrated to me by a Forest Range Officer. It appears that if a large owl (species not stated) is confined without food for 8 days and thereafter well beaten with a stick, it begins to talk fluently like a human (language unspecified!) and can be made to tell your fortune with infallible precision. Here is a tip for those waiting for ships to come home!

Ketupa zeylonensis leschenaulti (Temminck) The Brown Fish-Owl.

Specimens collected : ♀ Biligirirangan Hills (without precise data).

[Measurements : 1 ♀ Bill 51, Wing 402, Tail 200 mm.—H. W.]

Noted : Antarsāntē (29-11-39 A pair by forest tank at dusk).
Probably not uncommon in suitable localities—about tanks and streams.

Otus bakkamoena sub-sp. The Scops Owl.

No specimens.
The characteristic call of this little owl '*Wūt . . . wūt*' &c was heard after dusk at Nāmadachilumē and Settihālli, 1 and 30 January. Evidently somewhat uncommon.

Athene brama brama (Temm.) The Southern Spotted Owlet.

Specimens collected : 137 ♂ 22-11-39 Bandipūr (2,800′—Hangala village); 272 ♂ 5-12-39 Antarsānte (2,500′); 386 ♀ 19-12-39 Māklidrūg (2,800′); 395 ♀ 20-12-39, 461 ♀ 26-12-39 Dodballapūr (2,900′). *Biligirirangan Hills* : M28(G) ♀ 13-7-34 (3,000′—Ūdahatti M30(G) ♂ 21-9-34 (2,000′—Satyamangala).
Elsewhere noted : Chamarājanagar.

[Measurements :

	Bill	Wing	Tail
3 ♂♂	19.5-20	148-156	68-73 mm.
4 ♀♀	20.5-21	152.5-154	69-72.5 mm.

All are dark birds.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects groves of large trees in the neighbourhood of towns, villages and cultivation.

No. 272 (5 December) was very fat.

Glaucidium radiatum radiatum (Tickell) The Malabar Jungle Owlet.

Specimens collected : 173 ♀, 174 ♀, 175 ♂ 25-11-39 Bandipūr (3,000′—near Kākenhālla); 210 ♀, 211 ♂ 30-11-39 Manchgowdanhalli (2,500′); *Biligirirangan Hills*: M1(H) ♂ 10-3-34 (4,000′); M15(G) ♂ 15-9-34 (2,000′—Satyamangala); M34(G) ♂ 22-10-34 (5,000′—Honnametti).

[Measurements :

	Bill	Wing	Tail
5 ♂♂	17.5-19	130-133	68.5-76.5 mm.
3 ♀♀	16-18.5	129.5-133.5	66-70.5 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope, occasionally entering the dry-inter belt. Its typical habitat is teak and bamboo forest.

The stomach of one example contained a grasshopper and the viscera of a snail.

Ninox scutulata hirsuta Temm. The South Indian Hawk-Owl.

Specimen collected : 736 ♀ 26-1-40 Settihālli (2,500′).

Elsewhere noted : Edbūthi (4,500′—Biligirirangans).

[Measurements : 1 ♀ Bill 22, Wing 212.5, Tail 121.5 mm.—H. W.]

The specimen was shot off the roof of the Forest Lodge after dark. Two or three other birds were heard calling in the deciduous bamboo forest in this neighbourhood. The call of this owl is a distinctive, rather pleasant, *Oo...ūk, oo...ūk* etc. repeated once a second and 4 to 10 times running. A pause of half to one minute follows and then the calls are repeated.

The ovary of the specimen was maturing; largest follicles over 2 mm. A tangle of 13 round thread-like Nematode worms (*Parhamatospiculum* sp. (Fam. Filariidae)], from 25 to 80 mm. long (mostly over 50 mm.), were removed from under the skin of the skull above one eye-socket. Otherwise the bird seemed perfectly healthy. Its stomach (at 8 p.m.) was crammed with remains of what were apparently Potter Wasps (*Eumenes*)—orange brown in colour.

Pandion haliaëtus haliaëtus (Linn.). The Osprey.

Specimen collected : 287 ♂ 8-12-39 Seringapatām (Palahally Island, Cauvery, 2,000′).

Elsewhere noted : Marikānivē (Solo on Vanivilās Sāgar 7 Jan.).

[Measurements : 1 ♂ Bill 41.5, Wing 481, Tail 210 mm. H. W.]

Winter visitor. Scarce.

Sarcogyps calvus (Scop.). The Black or Pondicherry Vulture.

No specimens.

Noted : Bandipūr, Marikānivē.

Occasional solos.

Gyps fulvus fulvescens Hume. The Indian Griffon Vulture.

No specimens.

Noted (unconfirmed) at Jōg where several pairs were nesting on ledges of rock scarp a few hundred yards downstream from the Gersoppa Falls (10 February).

Gyps indicus [indicus (Scop.)] The Long-billed Vulture.

Humayun Abdulali records a few pairs nesting on cliffs opposite Jōg Falls at end December 1935. (*J.B.N.H.S.*, xxxviii, 830).

Pseudogyps bengalensis (Gmelin). The Indian White-backed Vulture.

No specimens.

Noted: Settihālli, Jōg and elsewhere.

A single nest with bird brooding was observed on a tall straight tree ca. 60 ft. up, in forest of moist-inter facies at Settihālli. No other nests were in the proximity, but the birds were here numerous, and it was evident from the acid reek of their droppings and the dirty whitewashed appearance of the ground that they roosted in the adjoining area at night.

At Jōg a number of nests with birds either brooding or perched in their proximity were observed on tall upright trees in evergreen forest. (10-2-40).

Neophron percnopterus ginginianus (Latham). The Smaller White Scavenger Vulture.

No specimens.

Noted: Biligirirangan Hills (about cattle sheds and coolie lines on coffee estates); Bandipūr, Sātnūr, Chitaldrūg, Mysore, Bangalore, Dodballapūr, Kolār Gold Fields and elsewhere.

Resident. Common. Confined to deciduous biotope. Occasionally met with in the intermediate zone around human habitations.

On 9 January a bird was observed carrying building material, and nesting was in progress on the bare rocky hills in the environs of Chitaldrūg town.

Major E. G. Phythian-Adams has one egg each from 2 nests at Nanjangūd, 2-2-1939.

Falco peregrinus peregrinator Sundevall. The Shahīn Falcon.

No specimens.

Noted: Balmoorie Island (Cauvery river, near Krishnarājsāgar); Devārāyadrūg (3,500′—Tūmkūr Dist.); Bābābūdan Hills (5,000′—above Kemmangūndi); Jōg (on cliffs flanking Gersoppa Falls).

Solitaries or a pair were seen about cliffs and rock scarps in the hills. On 22 January a pair had their nest on an inaccessible ledge of rock in the Bābābūdans (ca. 5,000′ elevation). The owners were observed playfully stooping about the cliffs at incredible speed, and performing a variety of amazing aerobatics.

Falco tinnunculus tinnunculus Linn. The European Kestrel.

Specimens collected: 144 ♀ 22-11-39 Bandipūr (3,300′); 337 ♂ 15-12-39 Sātnūr (2,500′); 396 ♂ 20-12-39 Dodballapūr (2,900′); *Biligirirangan Hills*: M35(G) ♀ 22-10-34 (5,000′—Honnametti).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	21-22	234-253	161-166 mm.
2 ♀♀	21.5-22	249-255	163-170 mm.—H. W.]

Falco tinnunculus objurgatus (Stuart Baker). The Indian Kestrel.

Specimens collected: 841 ♀ 7-2-40 Āgūmbē (2,000′). *Biligirirangans*: 6 ♂ 6-11-39 M40(G) ♀ 22-10-34 (5,000′—Honnametti) also 1 without precise data.

[Measurements :

	Bill	Wing	Tail
3 ♂♂	21.5-22	222-232	145-158 mm.
2 ♀♀	22-22.5	242.5-253	164-175 mm.—H. W.]

Tinnunculus winter visitor; *objurgatus* resident.

Usually seen singly about grassy hillslopes and in bare open sparsely scrubbed country and fallow land, mostly in deciduous biotope.

Aquila rapax vindhiana Franklin. The Indian Tawny Eagle.

No specimens.

Noted only at Marikānivē 7-1-40. Evidently rare.

Lophotriorchis kieneri (de Sparre). The Rufous-bellied Hawk-Eagle.

No specimens.

Noted: Settihālli (2,500′—Shimōga Dist.). A solitary bird perched bolt upright in a lofty bare tree on edge of forest clearing for teak plantation; moist-inter belt.

Ictinaëtus malayensis perniger (Hodgs.). The Indian Black Eagle.

No specimens.
Noted: Biligirirangan Hills 5,000′. Solo 19-12-32.

Circaëtus ferox (Gmelin). The Short-toed Eagle.

Specimen collected: 154 ♀ 23-11-39 Gopālaswāmi Betta (4,800′—near Gūndlūpet).
Elsewhere noted: Birūr (Solo in dry scrub-and-bush country about cultivation).

[Measurements: 1 ♀ Bill 53.5, Wing 525, Tail 278 mm.

This specimen is considerably darker above and has the markings on the lower surface both heavier and darker than in my series of North Indian birds. Unfortunately there are no other South Indian birds available for comparison—except 2 unsexed skins marked vaguely 'Madras' in the British Museum—so it remains to be ascertained whether there is a dark southern race or whether the difference is due to individual variation. This eagle varies a certain amount in plumage.—H. W.]

Resident. Apparently confined to deciduous biotope. The specimen was ready to breed. Largest ovum 6 mm. Its stomach contained a snake (*Psammophis condanarus*) 9″ long, and loose snake scales. Strangely enough this is the first record of this snake from Mysore.

Haematornis cheela melanotis (Jerdon). The Crested Serpent-Eagle.

Specimens collected: 724 ♀ 23-1-40 Bābābūdan Hills (3,500′—below Kemmangūndi); 816 ♀ 2-2-40 Settihālli (2,500′).
Elsewhere noted: Heggadedavankotē, Nāmadachilumē.

[Measurements:

	Bill	Wing	Tail
No. 724 ♀	46.5	497	294 mm.
No. 816 ♀	43.5	424	260 mm.

No. 816 is a perfectly typical example of *melanotis* in both size and colour. No. 724 on the other hand would pass both in size and colour as a specimen of *H. c. cheela*. One can either consider it therefore as a vagrant wanderer of the typical race which has somehow reached South India, or as an aberrant specimen of the race *melanotis* varying towards the typical race. I prefer the latter explanation for I have already pointed out (*J.B.N.H.S.*, xxxviii, 426-427) how very variable this eagle is.—H. W.]

Resident. Affects heavy forest both in evergreen biotope and in the intermediate zone.

The ovary of No. 724 (23 Jan.) was maturing with many of the follicles over 2 mm. in diameter. It was very fat. Its stomach contained snake scales.

The call of this eagle is distinctive and usually the first indication of its presence in any locality. It is a shrill *kek-kek-kek-kek-kek-kek-kée*—the final note prolonged and particularly shrill. This call is mostly uttered on the wing.

Butastur teesa (Franklin). The White-eyed Buzzard-Eagle.

Specimens collected: 138 ♀ 22-11-39 Bandipūr (2,800′—near Hangala village); 199 ♀ 29-11-39 Antarsāntē (2,500′).
Elsewhere noted: Settihālli.

[Measurements:

	Bill	Wing	Tail
1 ♀ ad.	32	309	183 mm.
1 ♀ imm.	31	278	158 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects open light secondary jungle and the vicinity of cultivation.

Haliastur indus indus (Boddaert). The Brahminy Kite.

Specimen collected: *Biligirirangan Hills*: M103(G) ♀ 29-7-34 (3,000′—Ūdahatti).
Elsewhere noted: Antarsāntē, Jōg, Kolār Gold Fields, Sātnūr,

Resident. Fairly common. Confined to deciduous biotope near tanks and rivers, but met with temporarily elsewhere in search of food. On 10 February a solitary example was observed flying up and down the Gersoppa Falls, sticking to the contours of the flanking crags, using the wind eddies to rise effortlessly without wing beats to the head of the falls. After circling round here in among the spray a couple of times the bird shot down (also along the contours) at great speed almost to the foot of the falls, with wings half pulled in like a Peregrine stooping. The entire performance was repeated again and again, its object remaining a mystery.

At Antarsāntē a nest was observed, with bird brooding, in the top of a large peepal tree growing in the village (5 December).

Milvus migrans govinda Sykes. The Common Pariah Kite.

Specimen collected : 145 ♂ 23-11-39 Bandipūr (3,300′).

Elsewhere noted : Chamarājanagar, French Rocks, Mysore, Bangalore, Thōndēbhāvi, Marikānivē. Almost ubiquitous.

[Measurements : 1 ♂ Bill 38, Wing 452, C. Tail 221, Outer Tail 284 mm. —H. W.]

Resident. Preferentially in deciduous biotope, but small numbers also in the moist-inter belt around human habitations in the low country, and ascending temporarily in search of food to the highest homesteads in the hills. All the time from 4 November to 6 January the breeding season was in progress. Many pairs were observed in copula and numerous nests with birds brooding or under construction were observed.

The testes of the specimen measured 17×6 mm.

Elanus cæruleus vociferus (Latham). The Black-winged Kite.

Specimens collected : 75 ♀ 15-11-39 Bandipūr (3,300′); *Biligirirangans* : M107 (G) ♂ 1-8-34 (3,000′—Ūdahatti, Eastern base).

[Measurements :

	Bill	Wing	Tail
1 ♂	23	—	122 mm.
1 ♀	24	269	119 mm.—H. W.]

Resident (presumably). Uncommon. Confined to deciduous biotope. Affects secondary and scrub jungle.

Circus macrourus (S. G. Gmelin). The Pale Harrier.

Specimen collected : 129 ♂ 20-11-39 Bandipūr (3,300′).

[Measurements : 1 ♂ ad. Bill 26.5, Wing 345, Tail 213 mm.—H. W.]

Winter visitor. Not common.

Stomach of the specimen contained remains of a lizard, and a quail chick about 1 day old.

Circus aeruginosus aeruginosus (Linn.). The Marsh Harrier.

No specimens.

Noted : Saklēshpūr (solo at swamp 15-1-40); Kolār Gold Fields (Bētmangala tank 22-2-40.

Winter visitor. Not common.

Astur badius dussumieri Temm. & Laug. The Indian Shikra.

Specimens collected : 288 ♀ 8-12-39 Seringapatām (2,000′—Palahally Island, Cauvery river); 336 ♀ 15-12-39 Sātnūr (2,500′); 468 ♂ 27-12-39 Dodballapūr (2,900′); 507 ♂ 29-12-39 Thōndēbhāvi (2,500′); 515 ♂ 1-1-40 Devārāyadrūg (3,500′); 756 ♂, 757 ♂ 28-1-40, 805 ♀ 2-2-40 Settihālli (2,500′); *Biligirirangan Hills* : M40(G) ♂ 23-9-34 (2,000′—Satyamangala).

[Measurements :

	Bill	Wing	Tail
3 ♂♂ ad.	20-21.5	176-192.5	133-147 mm.
1 ♀ ad.	23	201	160 mm.
3 ♀♀ imm.	21.5-22	193-200	150-165 mm.

In the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxviii, 432) I discussed the question of the races of this species at some length, and this fine series merely strengthens the views that I arrived at then.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects wooded country and groves frequently in the neighbourhood of villages and cultivation.

No 288 (8 December) was the only one of the Survey specimens that showed any gonadal development: ovarian follicles 2 mm. It was very fat. It dashed out of its ambush after a Rosy Pastor. No. 805 had all the primaries and some secondaries of one wing, and also the tip of its tail singed for about half their length. Presumably this was caused accidentally while hunting in a fired grass and scrub patch (*taungya* clearing).

Accipiter virgatus besra Jerdon. The Southern Besra Sparrow-Hawk.

Specimens collected: *Biligirirangan Hills*: 35 ♀ 10-11-39 (4,000′—Bedagūli); M25(H) ♂ 30-3-34 (5,000′—Honnametti).

[Measurements :

	Bill	Wing	Tail
1 ♂ imm.	18	155	127 mm.
1 ♀ ad.	22	183.5	142 mm.—H. W.]

Resident. Shot in the moist-inter belt. The stomach of 288 contained remains of a Green Barbet (*Thereiceryx viridis*).

Pernis ptilorhynchus ruficollis Lesson. The Indian Crested Honey-Buzzard.

Specimens collected: 189 ♀ 28-11-39, 269 ♂ 5-12-39 Antarsāntē (2,500′); 252 ♂ 3-12-39 Karāpūr (2,500′).

Elsewhere noted: Biligirirangan Hills 4,000-5,800′.

[Measurements :

	Bill	Wing	Tail
2 ♂♂ ad.	41-41.5	412-417	252-259 mm.
1 ♀ imm.	40	403	262 mm.—H. W.]

Resident. Fairly common. Particularly plentiful in the neighbourhood of Antarsāntē. The stomachs, crops and gullets of the specimens were crammed with wax and honey, and in one instance also some small bees (species?).

No. 189 was very fat. 269 (5 Decr.) had maturing testes—17×6 mm When incised for removal of tendons, it was noticed that all its 8 toes were infested under the skin with Nematode worms (*Pelecitus* sp.), especially at the base of the claws.

Crocopus phoenicopterus chlorogaster (Blyth). The Southern Green Pigeon.

Specimens collected: 195 ♂ 29-11-39, 268 ♂ 5-12-39 Antarsāntē (2,500′). *Biligirirangan Hills*: M24(H) ♀ 18-3-34, M72(G) ♂ 22-7-34, M97(G) ♂ 27-7-34 (3,000′—Ūdahatti Eastern base).

[Measurements :

	Bill	Wing	Tail
4 ♂♂	21-23	185-192	116-118 mm.
1 ♀	24	184	— mm.—H. W.]

Resident, but locally migratory (especially altitudinal) depending upon the ripening of the various fruits that comprise their food. Fruits ripen later on the hills than in the plains.

This Green Pigeon is essentially a bird of deciduous biotope but it also occurs freely in the dry-inter belt.

At Bandipūr their food consisted largely of *Ficus* figs and gall-nuts (myrabolans).

Dendrophassa pompadora affinis (Jerdon). The Grey-fronted Green Pigeon.

Specimens collected: 803 ♂ 1-2-40 Settihālli (2,500′); 818 ♀ 4-2-40 Āgūmbē (2,500′) 871 ♂ 12-2-40 Jōg (2,000′).

Elsewhere noted: Bābābūdan Hills 3,000-4,500′.

[Measurements :

	Bill	Wing	Tail
2 ♂♂	18.5-20	141.5-142.5	85 mm.
1 ♀	19	149.5	84 mm.—H. W.]

Resident. Fairly common. Locally migratory as above. Confined to evergreen biotope; also found in the moist-inter belt. Affects shade trees (*Ficus* and others) in and about coffee plantations. Its call notes are like *Crocopus*, but somewhat shriller. I was informed by Mr. H. H. English, a coffee planter in the Bābābūdans, that on his estate these pigeons frequently dash into the walls of out-houses and get killed. I have recorded a similar case under the Bronze-winged Dove in the Travancore-Cochin Survey (*J.B.N.H.S.*, xxxix, 339).

Ducula badia cuprea (Jerdon). Jerdon's Imperial Pigeon.

Specimens collected: *Biligirirangan Hills*: 9 ♀ 7-11-39 (4,000′—Edbūthi); M47(H) ♀ 9-4-34 (5,000′—Honnametti).
Elsewhere noted: Saklēshpūr, Settihālli, Āgūmbē.

[Measurements: 2 ♀♀ Bill 30-30.5, Wing 227-231, Tail 166 mm.—H. W.]

Resident. Fairly common. Confined to evergreen biotope. Extends into the moist-inter belt. Met with in twos and threes on tall thinly foliaged trees. Call: a deep, rather mournful *Ūk-ook...ook* etc. uttered with tail slightly depressed, back arched and head lowered. The flight is attained by leisurely wing beats as in the House-Crow.

The specimen of 7 November had a mature ovary with the largest follicle over 6 mm. in diameter.

Muscadivora aenea pusilla (Blyth). The Ceylon Green Imperial Pigeon.

Specimen collected: *Biligirirangan Hills*: M27(G) ♀ 21-9-34 (2,000′—Satyamangala).
Elsewhere noted: Antarsāntē.

[Measurements: 1 ♀ Bill 27.5, Wing 216, Tail 138 mm.—H. W.]

Resident. Uncommon. Confined to deciduous biotope, extending diminishingly into the intermediate zone. Affects secondary jungle dotted with large *Ficus* trees.

Chalcophaps indica indica (Linn.). The Bronze-winged Dove.

Specimen collected: *Biligirirangan Hills*: M37(G) ♀ juv. 23-10-34 (4,000′—Bellaji).
Elsewhere noted: Bābābūdan Hills (4,500′—Kemmangūndi); Settihālli.
Resident. Uncommon. Confined to evergreen biotope; partial to the moist-inter belt. It also extends to the more deciduous but well wooded portions of the intermediate zone. Frequents thick secondary forest and bamboo patches, and outskirts of forest clearings.

Columba livia subsp. The Blue Rock-Pigeon.

No specimens.
Noted: Bhadrāvati, Jōg.
Resident. Patchily distributed and nowhere abundant except at Jōg (Gersoppa Falls). At the Mysore Iron Works, Bhadrāvati, I noticed (24 Jan.) that while the casting was in progress (8 p.m.) a number of pigeons roosted complacently on the cross beams and rafters of the corrugated casting-shed roof, regardless of the terrific heat, glare and spluttering 'fireworks' from the molten metal, and only a few feet above the sparks from the gigantic blast furnace!

About the scarps of Gersoppa Falls the number of these pigeons has to be seen to be believed. They are there literally in thousands and when flying to and fro across the rock faces, as they do all day long in vast flocks, the birds look like swarms of midges by comparison with their surroundings.

There is a very widely current legend about the storing of grain by 'birds' obviously meaning these pigeons, in the holes and fissures of the rock behind and on the flanks of the actual waterfall at Gersoppa. This legend even had the distinction of figuring in a local political speech recently (Bangalore, 17-1-40) but what its exact significance was in the context is not understood. It is said that the birds hoard—or at least used to hoard in by gone days—paddy in such quantities that the right of collecting this grain was formerly auctioned out by the Bombay Government for as much as Rs. 500 annually. 20 candies (140 cwt.) or more are alleged to have been recovered at a time by a man lowered in a basket. Since the accident which terminated the career of this intrepid exploiter, no one else has ventured to tap the 'granaries'. Needless to say there seems to be no one living at the moment who has any first hand knowledge of the matter. Enquiries in the relative Mamlatdar's office, kindly made for me by the Divisional Forest Officer of Karwar, revealed that all records over 50 years old have been destroyed and the entries of revenue from the auction of the garnering rights cannot now be traced.

It has not been explained how the pigeons could have transported such vast quantities of paddy to the granaries, and from where—since at the present time, at any rate, there is no extensive paddy cultivation, such as is implied, within many miles of the Falls. Of course, the legend will not bear scrutiny, but it would be interesting to learn how it originated and managed to gain such wide and ready credence.

Columba elphinstonii (Sykes). The Nilgiri Wood-Pigeon.

Specimens collected: *Biligirirangan Hills*: M43(H) ♀ 7-4-34 (4,000′—Bellāji); M48(H) ♀ 9-4-34, M36(H) ♀ 10-5-34 (4,000-5,000′—Honnametti); M116(H) o? 25-5-34 (4,000′—Edbūthi).

Elsewhere noted: Devarbetta Hill (3,000′); Bābābūdan Hills (4,500′—Kemmangūndi).

[Measurements: 3 ♀♀ Bill 27-28, Wing 199-205 mm.—H. W.]

Resident. Fairly common but not abundant. Confined to evergreen biotope and partial to the moist-inter belt. Seen singly or in pairs, occasionally small parties, on trees in fruit.

Streptopelia orientalis erythrocephala (Bonaparte).[1] The Indian Rufous Turtle Dove.

Specimens collected: 792 ♀, 793 ♀ 31-1-40 Settihālli (2,500′).

[Measurements: 2 ♀♀ Bill from feathers 16, Wing 176-178, Tail 118-120 mm.

The sight of these two skins has given me as much pleasure as any birds in the Survey, for at last Mr. Sálim Ali has produced specimens of the Rufous Turtle Dove which breeds in Peninsular India, a bird whose very existence I was almost beginning to doubt. Curiously enough about the same time I received a third specimen from the collection of the late Mr. E. A. D'Abreu[2], a female (one of a pair) collected at Mahrājbāgh, Nāgpūr, on 8 June 1938. In the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxviii, pp. 677-678) I discussed the whole question of these doves, but in the absence of satisfactory proof of the breeding of any form in peninsular India my conclusions were not altogether satisfactory. I am now satisfied that my 'richly coloured form' of that account falls into two races. The bird of the Eastern Himalayas and Assam is really an intermediate between *S. o. orientalis* (Manchuria, Korea, Japan and Tibet) *S. o. meena* (Western Himalayas) and the breeding bird of peninsular India which is distinguished by the vinous-red crown, nape and mantle and the deeper red of the edges of the scapulars, coverts and tertiaries. The vinous-red of the undersurface is also much richer.

For the East Himalayan intermediate I propose to retain, as in my previous note, the name of *Columba agricola* Tickell, *J.A.S.B.* vol. ii (Nov. 1833) p. 581—jungles of Dholbhum and Borabhum. The description is a poor one but obviously refers to some form of Turtle Dove. There are no specimens available from these 2 localities, but Beavan obtained specimens at Manbhum, now in the British Museum, and these agree with East Himalayan birds.

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[1] Since this is the resurrection of an old existing name, Koelz's *sylvicola* (type locality: Castle Rock, *Proc. of the Biol. Society of Washington,* vol. lii, pp. 61-82 [5 June 1939]) becomes a synonym of it.

[2] It may be convenient to record the fact that Mr. D'Abreu's private collection of birds from Kumaon, Sikkim, Bihar and the Central Provinces has been very generously presented to me by his son and is now being incorporated in my own collection. The labelling of these birds is a model to collectors.—H. W.

Specimens from Raipur, Seoni and North Kanara in the British Museum evidently belong to the same very richly coloured resident form as these Survey birds. For them I propose to use the name *Turtur erythrocephalus* Bonaparte, *Consp. Gen. Av.* vol. ii (after April 15, 1855) p. 60 of which the type labelled 'Cape of Good Hope' is in the British Museum. The type locality is of course an error.—H. W.

The specimens were shot on a cart road through forest in bamboo facies of the dry-inter belt. A number of other examples were observed and the species seemed to be fairly common in this locality.

No. 792 had a soft ovarian egg 17 mm. in diameter, and the distended oviduct indicated that she had laid. The ovary of 793 was mature: largest follicle 6 mm.

Streptopelia chinensis suratensis (Gmelin). The Indian Spotted Dove.

Specimens collected: 533 ♂, 534 ♂ 3-1-40 Nāmadachilumē (3,000'); 804 ♂ 2-2-40 Settihālli (2,500'); M13(G) ♂ 9-7-34 (3,000'—Ūdahatti, Eastern base)

Elsewhere noted: Bandipūr, Begūr, Sātnūr, Saklēshpūr.

[Measurements: 4 ♂♂ Bill 18-19.5, Wing 135-145.5, Tail 118-134 mm. —H. W.]

Resident. Common. Confined to deciduous biotope, extending into the dry-inter belt. Frequents wooded country around cultivation etc.

All the 3 specimens of January-February had fully mature testes (14×5, 13×5 and 10×5 mm.) and they were certainly breeding. On 27 January a nest with c/2 was found 6 ft. up in a bamboo clump in secondary jungle (Settihālli). In this locality it was the only dove besides *S. orientalis*.

Streptopelia senegalensis cambayensis (Gmelin). The Little Brown Dove.

Specimens collected: 553 ♀ 7-1-40 Marikānivē (2,500').

Elsewhere noted: Bandipūr, Begūr, Sātnūr, Thōndēbhāvi, Nāmadachilumē, Hiriyūr, Kolār Gold Fields.

[Measurements: 1 ♀ Bill 16.5, Wing 124, Tail 104 mm.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects dry open country less wooded than that favoured by the Spotted Dove, but sometimes the 2 habitats overlap at the seam. These facies preferences are most noticeable in the dry season when their boundaries are better defined than during or just after the rains.

The specimen had a mature ovary with the largest follicle measuring 3 mm.

Streptopelia decaocto decaocto (Frivalszky). The Indian Ring-Dove.

Specimens collected: 356 ♂ 16-12-39 Sātnūr (2,500'); 425 ♂ 23-12-39 Maklidrūg (2,800'). *Biligirirangan Hills*: M25(G) ♂ 20-9-34 (2,000'—Satyamangala), M37(G) ♂ 15-7-34 (3,000'—Udahatti, Eastern base).

[Measurements: 4 ♂♂ Bill 19.5-21.5, Wing 169-174, Tail 129.5-133.5 mm. —H. W.]

Resident. Common. Confined to deciduous biotope. Prefers drier and less wooded facies than the Spotted Dove, and often met side by side with the Little Brown Dove.

Elsewhere noted: Bandipūr, Begūr, Thōndēbhāvi, Marikānivē.

Both the December specimens were breeding: testes 17×6 and 17×7 mm. Major Phythian-Adams took an egg at Gūndlūpet, 28-7-38.

Œnopopelia tranquebarica tranquebarica (Hermann). The Red Turtle Dove.

Specimens collected: 366 ♂, 367 ♂ 17-12-39 Sātnūr (2,500'); 554 ♂ 7-1-40 Marikānivē (2,500').

Elsewhere noted: Kolār Gold Fields.

[Measurements: 3 ♂♂ Bill 16-5-18, Wing 136-140, Tail 84-89 mm.—H. W.]

Resident. Confined to deciduous biotope. Affects dry, open, secondary and scrub-and-bush jungle, and the neighbourhood of cultivation. The preferential facies of this dove is nearer that of the Ring Dove than of the Spotted Dove.

All the 3 specimens had testes enlarged to breeding size: 13×6, 16×5 and 17×6 mm. Major Phythian-Adams has taken eggs at Gūndlūpet 28-7-38.

(*To be continued.*)

THE LARGER DEER OF BRITISH INDIA

BY

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Part III—The Sambar (*Rusa*),

(*With 3 text-figures*).

(*Continued from Vol. xliii, No.* 4 (1943), p. 572).

Genus **Rusa** H. Smith.

(The Sambar).

Rusa, Hamilton Smith, Griffiths' An. King., 5, p. 309, 1827, and of most recent authors as a genus or as a subgenus of *Cervus.*

Type of the genus:—*Cervus unicolor.*

Distribution from Ceylon and India eastwards to the Philippines and beyond.

British Indian representatives of this genus are the largest of the typically Oriental Deer, approaching the Shou in size, but differing from *Cervus* in external characters similar to those of *Rucervus,* namely the long, bushy tail, absence of rump-patch and more extensive rhinarium, the chief external difference being in the antlers which are much simpler and carry normally only two terminal tines, the anterior or outer of which represents the trez tine of *Cervus* and may be longer or shorter than the other.

In the skull the auditory bullae are smaller than in *Rucervus* and closely resemble those of *Cervus,* (Fig. 1) only very seldom projecting slightly below the level of the basioccipital bone; but the chief cranial characteristic of typical *Rusa* lies in the great depth and size of the gland-pit, which far surpasses that of the other genera, and has a protrusible gland;[1] the vacuity also is relatively longer. A further difference from *Rucervus,* but resemblance to *Cervus,* is the presence of the upper canine tooth in the female.

Although the Sambars (*Rusa unicolor*) of the British Indian Fauna are referred in recent literature to two subspecies, one, *Rusa unicolor unicolor,* from Ceylon and most of India, the other,

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[1] In some of the small Sambars from the Far East the gland-pit is relatively smaller and shallower and the gland is not known to be protrusible.

Rusa unicolor equina from Burma and Assam, distinguished from the first by its shorter antlers, I find evidence for the admission of three, the Indian form being separable from the typical Ceylonese form, *R. unicolor*.

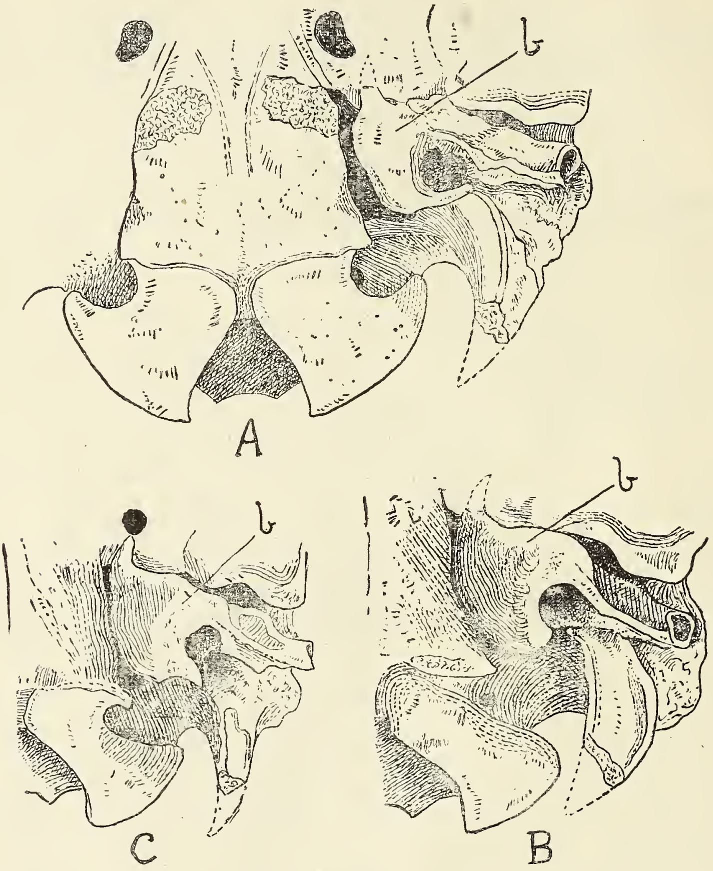

Fig. 1.

A. The small, flat left auditory bulla (*b*) of young-adult ♂ Sambar (*Rusa unicolor nigra*) from South Coorg (Shortridge).

B. The relatively larger, swollen auditory bulla (*b*) of adult ♂ Swamp Deer (*Rucervus duvaucelii*) from? Barainga (Earl of Derby).

C. The same of adult ♂ Thamin (*Panolia eldi*) from Burma (Zool. Soc.).

The light, falling from the right, throws the inner half of the swollen bullae of *B* and *C* into heavy shadow, whereas in *A* the flattish bulla casts no shadow.

They may be briefly diagnosed as follows:—

a. Tips of the antlers variable, the posterior-inner tine usually shorter, sometimes longer than the anterior-outer, sometimes equal to it, the anterior-outer usually but not always definitely continuing the line of the beam.
b. Antlers and skull on the average smaller. *unicolor*.
b^1 Antlers and skull on the average larger. *nigra*.

a^1 Tips of the antlers less variable, the posterior-inner tine always shorter than the anterior-outer, which always definitely continues the line of the beam.	*equina.*

Rusa unicolor unicolor, Kerr.

Cervus axis unicolor, Kerr, Anim. Kingd., p. 306, 1792.
Cervus axis major, Kerr, Anim. Kingd., p. 306, 1792.
Cervus albicornis; Bechstein, Allgemcin. Uebersicht vierfuss. Thiere, 1, 1799.
Rusa unicolor unicolor, Phillips, Man. Mamm. Ceylon, p. 337, 1935. (excluding references to Indian specimens).
Locality of the type:—Ceylon, as restricted by Hamilton Smith.
Distribution:—Ceylon.

Distinguished from the Indian Sambar, with which it has hitherto been united, by its average much shorter antlers which are not known to exceed 34 in. in length, and apparently by its smaller skull, although the evidence on this head is scanty.

This race can be soon dismissed since there are hardly any Ceylonese specimens in the British Museum to describe.

My information about the antlers is derived mainly from Phillips's volume. He states that their general average length is 26 or 27 in., the longest recently procured being 32½ and 33 7/8 in. In Ward's Records, 1935, p. 22, several are entered ranging from 27¾ to 32½ in. As regards the terminal tines Phillips states that they are generally approximately equal in length, but, if unequal, either may be the longer. On plate 35 he figures two heads. In the upper figure the antlers are of the primitive 'rusine' type, with the front-outer tine continuing the beam and greatly exceeding in length and thickness the hinder-inner tine. In the lower figure the two are short and subequal in size, resembling apparently rather closely the prongs of a hay-fork. On pl. 34 the two tines appear to be nearly intermediate between the previous two.

No ♂ skulls are available for description. But a ♀ skull from Aldie Patmas, C.P. (Phillips) is that of a youngish adult which had apparently attained its full length dimensions. Its total and condylobasal lengths are respectively 320 mm., about 12 4/5 in., and 315 mm., about 12 3/5 in., nearly 2 in. shorter than the average of five ♀ Indian skulls referred to under *nigra.* But the second Ceylonese skull, collected for the Survey by Mayor at Durgali C.P., would have been a little longer than Phillips's. Its condylobasal length is the same, namely 315 mm., and its total length a little greater; but it is a younger skull with the premolars of the first set still in use and its last molar just appearing in the bone. Since it had not quite reached its full length, it may be assumed that the two Ceylonese skulls would be about 1 in. shorter on the average than the Indian skulls, justifying provisionally the conclusion that the Sambar of Ceylon are smaller on the average than those from the mainland.

The technical name of this race was given by Kerr to a Deer described by Pennant (*Hist. Nat. Quadr.,* 1, p. 106, No. 48, 1781) as the 'Middle-sized Axis', a species as large as the Red Deer, with the ground-colour like that of the Axis but never spotted, the antlers strong, rough and trifurcated, meaning three-pointed. From hearsay evidence, there being no type, he cited Ceylon, Borneo, Celebes and Java as its localities. The name was restricted to the Ceylonese Sambar by Hamilton Smith in 1827.

I have included the names *major* and *albicornis* in the synonyms for the following reasons. Both were given to the 'Greater Axis' of Pennant (*op. cit.*, No. 48[1]); but in Pennant's first description (*Syn. Quadr.* p. 52, No. 41, 1771), the species, based on a pair of antlers in the British Museum without the least trace of locality or history, was described as having the antlers of the same shape as those of the Axis and trifurcated, but large, very thick, strong, rugged and 33 in. long. Since this description fits the antlers of the Ceylonese Sambar as well as any other, the names may be conveniently disposed of as synonyms of *unicolor*. In 1881 Pennant repeated this description, quoted by Kerr, but added the suggestion that the specimens probably came from Borneo or Ceylon. Acting on this Kerr definitely stated Borneo and Ceylon to be the homes of *major*, adding that its colour was 'reddish brown', both statements being unwarranted inventions.

Gray complicated the question by identifying as the antlers Pennant described, a pair in the British Museum (No. 697 *U*); and this verdict was endorsed in 1915 by Lydekker, who entered them as the type of *major* and *albicornis*. This claim cannot be upheld. The antlers in question are those of a Sambar, without history, but are very aberrant and not the least like those of an Axis in shape. One only is trifurcate and in this the tine near the summit of the beam rises on its outer side and projects outwards and upwards, a most unusual variation. In these respects the antlers entirely disagree with Pennant's description of those of the Greater Axis.

Rusa unicolor nigra, Blainville.

Cervus niger, Blainville, Bull. Soc. Phil. Paris. 1816, p. 76; Blyth, Journ. As. Soc. Beng., 11, p. 449, 1842.

Cervus aristotelis, Cuvier, Oss. Foss., ed. 3, Vol. 4, p. 503, 1825 and of many subsequent authors either as *Cervus* or *Rusa.*

Cervus leschenaultii Cuvier, Oss. Foss., ed. 3, Vol. 4, p. 506, 1825.

Cervus hippelaphus, H. Smith, Griffith's Anim. Kingd., 4, p. 105, 1827 and of several subsequent authors as *Cervus* or *Rusa*; but not *Cervus hippelaphus* Kerr, 1792 which is a European race of *C. elaphus.*

Cervus jarai, Hodgson, Gleanings in Sci., 3, p. 321, 1831.

Locality of the type of *niger,* unstated but probably somewhere in north India; of *aristotelis,* Nepal; of *leschenaultii,* Coromandel; of *jarai,* Nepal.

Distribution:—India apart from the western desert and semi-desert areas, but not perhaps crossing the Brahmaputra in the north-east, the Assamese Sambar belonging apparently to the next race.

Distinguished from the Ceylonese race by its potentially larger antlers and apparently larger skull.

In Rowland Ward's Records, 1935, there is a long list of antler-measurements ranging in length roughly from 37 to 50 in., almost all of the specimens having been procured in parts of Central India.

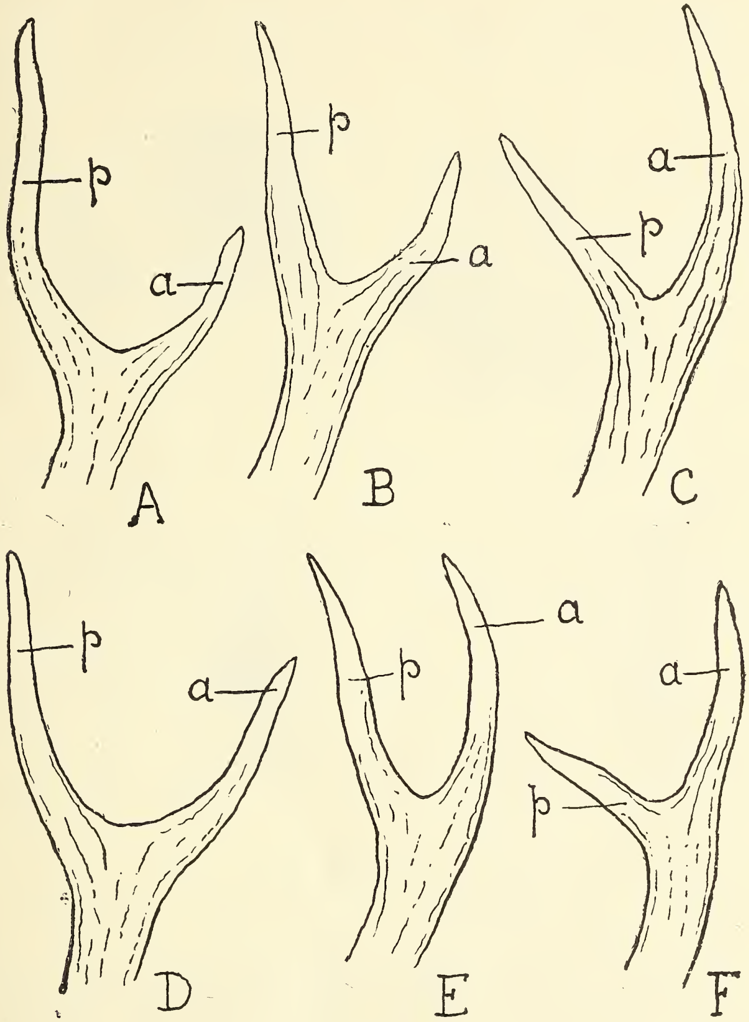

Fig. 2.

Variation in the length and direction of the two terminal tines of the antlers of the left side of the Indian Sambar. *a* the front-outer tine; *p*. the back-inner tine.

A. Antler, 46½ in., from Chanda, C.P. (Hume).
B. Antler, 43 in., from Khandwa, C.I. (Sharmon).
C. Antler, 37 in., from Rohtas, Bihar, (Walker).
D. Antler 42¾ in., from Central India (Anderson).
E. Antler, 36 in., from Bhopal.
F. Antler, 27½ in., of the primitive type. Drawn from an example of *equina* from the Ruby Mines, Upper Burma, (Bruce).

The antlers vary greatly in the comparative lengths and in the direction of the two terminal tines (fig. 2). As a general rule the front-outer tine is erect, definitely continues the line of the beam and is longer and generally stouter than the back-inner tine which inclines backwards, inwards and upwards. Almost equally commonly the two tines are subequal, forming a fork, and sometimes in this case neither can be said definitely to be a continuation of the beam. More rarely the back-inner tine is the longer of the two, sometimes much longer, and in this case also the front-outer tine cannot always be said to continue the line of the beam more than the other. Antlers of this rare type were figured by Blanford in 1891 and by Lydekker in 1915 as if they were characteristic of the Indian Sambar. Three are represented in fig. 2, A, B, D. In C, the much commoner type, the front-outer tine is longer and thicker than the other and manifestly continues the beam. In E, also a common type, the two tines are subequal and the front-outer is in line with the beam. In F, is represented a type quite usual particularly in smaller antlers of the Indian Sambar and characteristic, with minor differences in details, of the races of *Rusa unicolor* found to the east of the Bay of Bengal, in Formosa, the Philippines, Borneo and Sumatra.

Since, as above stated, nearly all the antlers of the Indian Sambar considered on account of their size, worth entering in Ward's Records came from Central India or at all events from districts to the south of the Ganges, a few notes on those from the north of the river, about which little has been recorded, may be of interest. The specimens in the British Museum and the few recorded by Ward give the following length measurements. Eight from Nepal vary from 29 to 35 in., the average being 32 in., two from Oudh are 36½ and 40, with the average about 38; three from Dehra Dun vary from 32 to 40, with an average of 36; three from Garwhal vary from 35 to 46½, the average being about 40; and three from the United Provinces vary from 40 to 46½, with the average about 43. The total average of the series is about 38 in., probably approximately the average of mature antlers of the southern Indian Sambar, if anything a little over it. These northern antlers resemble the southern not only in size but also in the variation of the terminal tines which may be subequal or unequal, quite a large percentage having the back-inner tine the longer. An instance of individual variation is supplied by a pair from Dehra Dun (Hume) in which the right antler is 36 in. long, with the two tines subequal, the left 39½ in., with the back-inner tine much longer than the front-outer approximately as in the head from Chanda, C.P., figured by Lydekker. It is perhaps surprising that none of the north Indian antlers described shows greater proximity to those of the Burmese race than do those from Central India.

The skull of the ♂ Indian Sambar exceeds in length the skulls of the other species of British Indian Cervidae, apart from Wallich's deer (*Cervus wallichii*) and the Shou (*Cervus affinis*). But it is narrower than the skulls of *Cervus*. Although its total length is on the average over 20 mm. longer than in the Hangul (*Cervus hanglu*), the width across the orbit in the latter is on the average about 12 mm. greater, a feature which, combined with the shorter length, gives the skull a more robust appearance. The skull is very much larger than the skull of the Swamp Deer and Thamin, has relatively considerably smaller auditory bullae and much longer vacuities and bigger gland-pits.

In fourteen skulls the vertical diameter of the orbit varies from 47 mm. in a skull from Palamau to 61 mm., which is exceptional, in one from Nepal (Hodgson), the average being 52 mm. The length of the vacuity, which always exceeds the orbit, varies from 60 mm. in the type of *heterocerus* from Nepal to 80 mm., which is exceptionally long, in a skull from Garwhal (Burke), the average being 69 mm. The gland-pit, which is very deep, with well defined edges, usually exceeds in length the diameter of the eye, varies in length from 54 mm. in a skull from Kanara to 64 in one from Khandwa, the average being 58. The free edges of the nasals

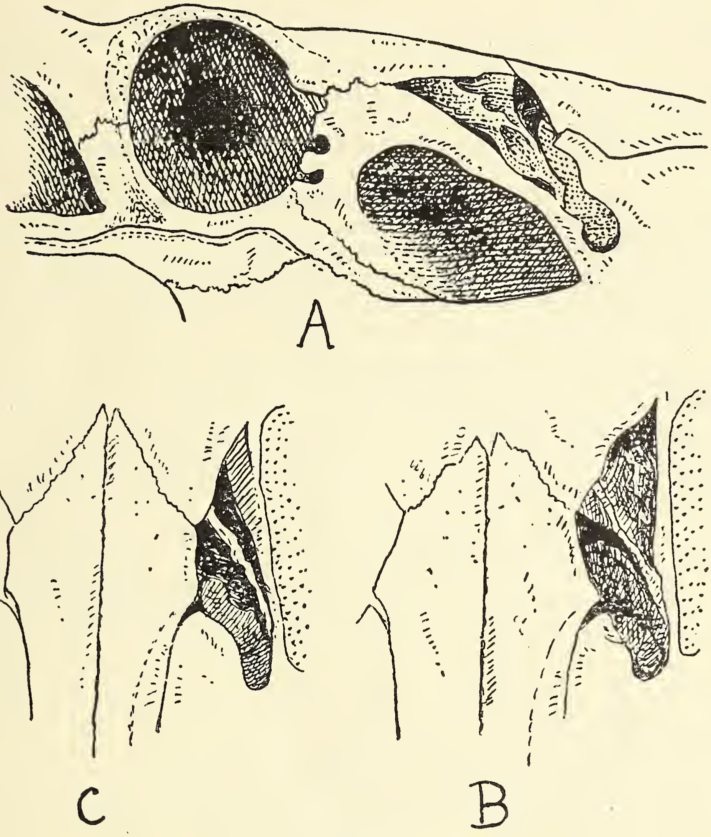

Fig. 5.

A. Orbital area of the skull with the vacuity and gland-pit of a Sambar (*Rusa unicolor nigra*) from Rohtas in Bihar (Walker).

B. Posterior end of the nasal bones, with the vacuity and inner portion of the gland-pit (dotted) of the same specimen.

C. The same of a specimen from Palamau (Walker).

where they border the vacuities internally are typically lightly convex but may be almost straight; they vary in length from 12 mm., which is exceptionally short, in the type of *heterocerus* from Nepal to 34 mm. which is exceptionally long, in the skull from Garwhal, which has the unusually long vacuities. On the average the posterior angle of the nasals is about on a level with the posterior ends of the vacuities, sometimes slightly surpassing them, sometimes falling short. But the nasals vary individually in nearby localities. In a skull from Rohtas in Bihar (Captain Walker), with the total and condylobasal lengths 420 and 408 mm., the nasals are much less than three times as long as wide, being 145 mm. long and 60 mm. wide at the widest point, their interfrontal penetration is comparatively short and the angle they form nearly rectangular and not quite reaching the line of the ends of the vacuities. But in a younger, but adult skull from Palamau (Captain Walker) with the total and condylobasal lengths 416 and 397 mm., the nasals are considerably more than three times as long as wide, their length being 150 mm. and their greatest width 45 mm.; they are correspondingly narrower (Fig. 3, B, C) throughout, with a deeper, interfrontal penetration, the angle they form being acute and surpassing by about 6 mm. the ends of the vacuities.

As regards the length of the entire skull, the longest two are those from Rohtas and Palamau above mentioned. Out of thirteen adult skulls nine surpass 400 mm. in total length, the shortest of this category being Hume's skull from Chanda with a total and condylobasal length of 403 and 382 mm. The localities and total length of four, which fall short of 400, are as follows:—Nepal 398, Kanara 395, Garwhal 394, Rajputana 390. In the last three of these the condylobasal length is not available; but another skull from Nepal (Hodgson) has the total and condylobasal lengths 405 and 386 mm. and in one from Kumaun (Vanderbyl) those lengths are 407 and 390 mm. From these data it seems there is no difference in the size of the skulls of the Sambars found to the north and south of the Ganges. The average total length of thirteen skulls ranging from Kanara to the Himalayas is 405 mm.; and the condylobasal length of ten is 392 mm.

The particulars cited above apply only to ♂ skulls collected by sportsmen not interested in hinds. But the collectors for the Mammal Survey of British India secured several adult ♀ skulls in perfect condition. Three were from widely separated districts in India. Their localities and total and condylobasal lengths are as follows:—Sitabani, Kumaun, (Crump) 361 and 350 mm.; Mahableshwar, Satara, (Prater) 363 and 353 mm.; Wottekolle, S. Coorg, (Shortridge) 367 and 350 mm.; Nallamalais, (La Personne) 370 and 358 mm. Their uniformity in length is very close, the total length being about 367 mm. (14 3/5 in.) and the condylobasal length about 353 mm. (14 1/5 in.). A young ♀ skull was also secured by Shortridge at Makut, Coorg. An adult ♀ skull from Coimbatore (R. C. Morris) is a trifle larger than the largest of the preceding, its total and condylobasal lengths being 372 and 362 mm., but these measurements hardly appreciably increase the average length given above, of the skulls of ♀ Indian Sambar.

With regard to the names applied to the Indian Sambar, it is unfortunate that *niger,* based by Blainville on a painting, is several years older than the frequently quoted name *aristotelis* given by Cuvier to a sketch of antlers from Bengal sent to him by Duvaucel who reported that the stag was common in Nepal and towards the Indus. Since Bengal in those days extended considerably to the north of the Ganges and Duvaucel collected to the north of that river, *aristotelis,* like *niger*, belongs to the north Indian Sambar. But Cuvier supplied the Central and South Indian form with the name *leschenaultii,* based on a sketch of antlers from Coromandel. The future may show that the Sambar found north of the Ganges differ from those to the south of it; but since there is insufficient material to decide this point, I provisionally adopt the name *nigra* for all the Indian Sambars apart from those occurring in Assam.

Rusa unicolor equina Cuvier.

Cervus equinus, Cuvier, Oss. Foss., ed. 2, 4, p. 45, 1823, and of subsequent authors including Lydekker, Cat. Ung. Brit. Mus., 4, p. 78 containing bibliography under *Cervus unicolor equinus.*

Cervus malaccensis, F. Cuvier, Hist. Nat. Mamm., 1, pl. 10, 1824.

Cervulus cambojensis, Gray, Proc. Zool. Soc., 1861, p. 138.

Rusa dejeani, Pousargues, Bull. Mus. Paris, 1896, 2, No. 1, p. 12, 1896; G. M. Allen, Mamm. China and Mongolia, 2, p. 1169, 1940 as *Rusa unicolor dejeani.*

Rusa unicolor equina, Pocock, Ann. Mag. Nat. Hist. (11), IX, p. 518, 1942.

Locality of the type of *equinus,* Sumatra; of *malaccensis* the Malay Peninsula; of *cambojensis* Cambodia; of *dejeani* Szechwan.

Distribution:—From Sumatra, through Malaya to Burma and Assam, Siam, Cambodia, Cochin China, Annam, Yunnan, Szechwan, Hainan.

Distinguished from the Ceylonese and Indian races by the terminal tines of the antlers being much less variable in their respective lengths, the front-outer always definitely continuing the line of the beam and being longer and thicker than the back-inner which projects inwards, backwards and upwards from its inner side; the antlers also are much shorter on the average than in the Indian race, with the brow tine longer compared with the beam and there is some evidence that the skulls are a little shorter on the average.

According to Peacock (Game Book for Burma, p. 124, 1933) the average length of the antlers in mature Burmese Stags is about 26 in., 30 in., or a little over, being considered large. This was confirmed by H. C. Smith (Wild Animals of Burma, 1, p. 39, 1935). In Ward's Records for 1935 the picked Burmese heads entered as trustworthily measured range from 29 to 33 in. In a skull from the Ruby Mines (Bruce) in the British Museum, the antlers are 27½ in.; a pair from the Garo Hills, Assam (Hume) are 28 in.; but a pair labelled Assam (Cutler) are only 19¼ in. From Malewoon and Victoria Island, Tenasserim Lyon (*Proc. U. S. Nat. Mus.*, 31,

p. 585, 1906) measured four heads with antlers ranging from about 23 to 33½ in., the average being 27 in., thus agreeing with the previous entries; and in Ward's Records 1935 a few no doubt picked heads from various parts of Indo-China ranging from about 28 to 33 in. are entered, showing close agreement with Burmese antlers. There thus appears to be very little difference in the average size of the antlers in the Sambars of continental Asia to the east of the Bay of Bengal. For these the oldest available name is *malaccensis*. There is some evidence, however, that in typical *equina* from Sumatra the antlers may be smaller. For instance a pair in the British Museum (Robinson) from Korinchi is 22 in. and in a series of ten from eastern Sumatra recorded by Lyon (*Proc. U. S. Nat. Mus.* 34, p. 633, 1908) the range is from about 15½ to 20½ in., the average being only 18 in. approximately. But although there is no evidence that all these specimens were fully developed, the data suggest that the typical form of *equina* from Sumatra may have on the average smaller antlers than those from the mainland, justifying the separation of the latter as a distinct local race, *malaccensis*. But since the evidence is unsatisfactory, I leave the accepted nomenclature undisturbed.

There are only two adult ♂ skulls of this race in the British Museum. They differ a good deal in details. One from the Ruby Mines, Upper Burma (Bruce), with a total length of 421 mm. is a few mm. longer than the longest known skull of *nigra* from Rohtas, but its condylobasal length of 400 mm. is 8 mm. less. The vertical diameter of the orbit and the length of the vacuity agree tolerably closely with the average of the Indian race; but the gland-pit is exceptionally long, 74 mm., exceeding by 10 mm. the longest recorded from India i.e. from Khandwa, which is 64 mm. The other skull from Assam with a total and condylobasal length of 380 and 372 mm. is younger and much shorter, but appears to have attained its full length. Its orbit, 57 mm., is large, but the vacuity, 53 mm., is exceptionally short, whereas the gland-pit, 60 mm. long, is approximately equal to the average in the Indian race.

As regards the length of the skull of *equina* Lyon (*Proc. U. S. Nat. Mus.*, 31, p. 585, 1906) recorded the basal length of three adult ♂ skulls from southern Tenasserim. From these I compute their condylobasal lengths to have been approximately 370, 375 and 395 mm. respectively. Of one adult ♂ skull identified as *dejeani* from Yunnan, G. M. Allen recorded the occipito-nasal length, from which its condylobasal length may be estimated to have been 384 mm. The average condylobasal length of these four skulls and of the two in the British Museum works out at 383 mm., about 10 mm. less than the average of nine ♂ skulls of *R. unicolor nigra*.

Three adult ♀ skulls were collected by Shortridge for the Mammal Survey at Banlaw in Mergui, Thagat in Tenasserim and probably at Tenasserim Town, although labelled merely Tenasserim. They vary individually in details. The Mergui skull has the vertical diameter of the orbit 46 mm., the vacuity 70 mm. long and the gland-pit 48. In the Thagat skull the same areas are 44, 46 and 57 mm. and in the Tenasserim Town skull 49, 61 and 48 mm. The vacuity is exceptionally long in the Mergui skull and the gland-pit in the Thagat skull. The averages of these areas in the three is 46, 59, and 51 mm. respectively, both the gland-pit and the vacuity exceeding in length the vertical diameter of the orbit. Both the orbit and the vacuity are smaller than the average of the five ♀ skulls of the Indian race; but the gland-pit is a little longer. The three skulls similarly vary in length, the condylobasal being 353 mm. in the skull from Thagat, 345 in the one from Mergui and 332 in the one from Tenasserim Town. But Lyon recorded from the Malay Peninsula a much bigger ♀ skull, which had a condylobasal length, I estimate, of about 373 mm. The average in the four skulls works out at about 351 mm., only 4 mm. less than in the five ♀ skulls of the Indian race.

(*To be continued*)

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. St. J. Macdonald,

(*With* 1 *plate, a map and* 3 *text-figures*).

(*Continued from Vol.* xliii, No. 4 (1943), p. 620).

Part IV.

FISHING FOR MAHSEER.

'Wild and wide are my borders, stern as death is my sway,
'And I wait for the men who will win me—and I will not be won in a day;
'And I will not be won by weaklings, subtle, suave and mild,
'But by men with the hearts of Vikings, and the simple faith of a child;
'Desperate, strong and resistless, unthrottled by fear or defeat,
'Them will I gild with my treasure, them will I glut with my meat'.
R. S.

The attributes of the good angler (1), The Mahseer's idiosyncrasies (2), Size no indication of age (3), Diet of Mahseer (4), Power of jaw (5), Spawning (6), Method of taking bait (7), Spoon versus other lures (8), Capt. F. Stonham's Note on Plug bait (9), Spoon bait and scale effect (10), Hen fish attains greater size (11), Spinning for Mahseer (12), Where to look for Mahseer (rapids) (13), Sketch of good water lettered (14), Pools (15), How to work water and the cast (16), Known water (17), How Mahseer rise (18), Monotony of one bait (19), Point of rod (20), Selection of water (21), Lacey's log of good and bad days with my summary (22), Wade cautiously (23), The element of luck (24), Water and temperature (25), Following in a boat (26).

Other Methods of Fishing for Mahseer (27), The fly and fishing with fly (28), Gram fishing for Mahseer (29), Method of Fishing (30), Gram for bait (31), Hooks (32), Cast lines (33), Tackle (34), Other tips (35), Paste fishing for Mahseer (36), Baiting with paste (37), Points relating to heavy fishing (38).

THE ATTRIBUTES OF THE GOOD ANGLER.

1. The patience of Job; the eye and observance of the eagle; the perseverance of the termite; the hands of an artificer; the touch of a musician; the temper of a saint; and, above all, an unsatiable ambition to learn.

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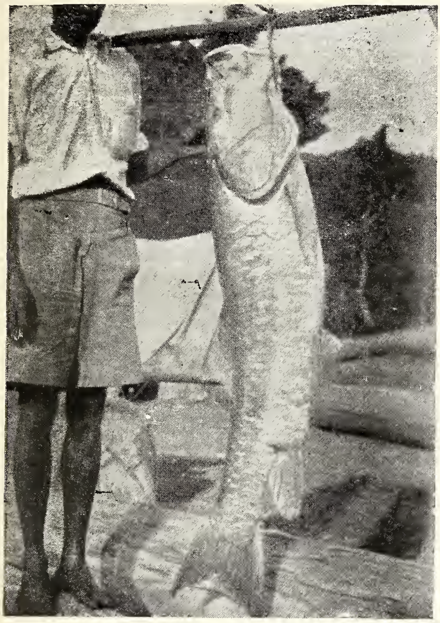
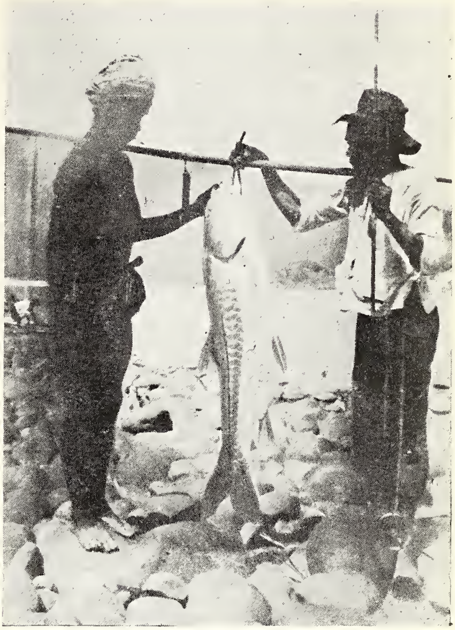
2. *The Mahseer's idiosyncrasies.* Before dealing with the actual fishing, it will be as well to consider a few important points about the mahseer which either directly or indirectly influence the methods to be adopted. The mahseer has certain idiosyncrasies, which are not in conformity with the salmon or trout. He likes clear water, in fact the clearer the better; the rougher and whiter the more does he love it; thunder and rain may or may not subdue his capricious appetite. They are taken in the winter, summer, spring and autumn. His size is no indication of his wants, the little chap of 1 pound or

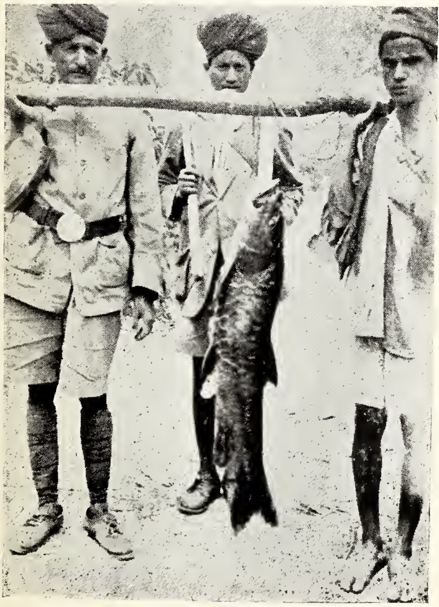
4. COMMON TYPES OF MAHSEER TAKEN IN MOST NORTH INDIAN RIVERS.



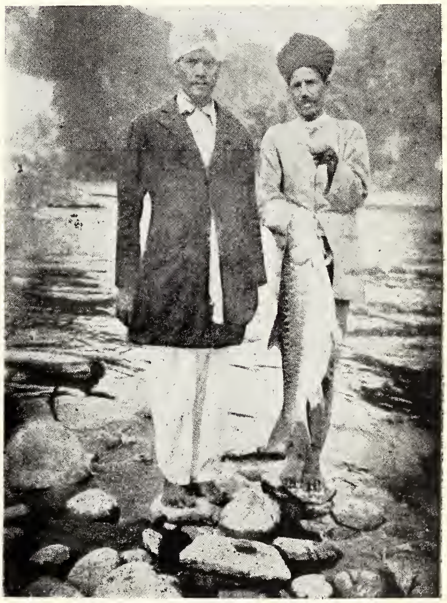
(1) A typical 'Golden Mahseer', 50 lbs.
Barbus (*Tor*) *putitora* (Hamilton).



(2) Thick-lipped 'Mahseer ', 52 lbs.
Barbus (*Tor*) *putitora* (Hamilton)
With hypertrophied lips.



(3) The 'Black Mahseer'. 26 lbs.
Barbus (*Tor*) *putitora* (Hamilton)
Melanic Form.



(4) Short gilled, deep-bodied type, 25 lbs.
Barbus (*Tor*) *tor* (Hamilton).

Note.—Dr. Hora's work on the Game Fishes of India has revealed that there is no reason to believe that 1, 2 and 3 are separated forms.

less will ambitiously take a 4-inch spoon, with the same readiness as the monster of 30 or 40 pounds takes a half-inch fly spoon; and most important of all when considering mahseer fishing, we have to bear in mind a fish ranging from a few ounces to one of 5 score pounds or more.

True, that in most rivers his size can be ascertained fairly accurately, but this is by no means the case with most of the larger rivers, which have the monsters mingled with the game little fellows of a few pounds. Few anglers who have fished the larger rivers have not experienced getting into one of these iron-clads while indulging in the gentle art with 9 ft. fly rod and fine gut casts, and many must be the recollections and regrets of good fish lost.

3. *Size no indication of age.* Fishing for large and small mahseer are things apart, and call for methods as widely separated as those used for the monsters of the sea of 100 pounds or more, with those employed for the game little trout of a pound or more, in a stream barely 3 feet across. The size of a mahseer is not necessarily any indication of age. A ten-year old fish in a small stream may only be 5 pounds, whereas a ten-year old fish in a big river may grow to 20 pounds or more. Like the salmon in Britain, the mahseer is the aristocrat of the Indian waters. His chief characteristic is the first rush As soon as he is hooked he may go 50 or 200 yards without stopping, depending on his size and the strength of the water. His choice for rapids and broken water makes him a strong fish, this is further illustrated by his area of fin. The mahseer, like most of the Indian fish, is not very tasty, and is inferior to the Butchwa and Murral; some people, however, prefer his flesh to any other.

4. *Diet of Mahseer.* He is a fish with a variety of tastes. He will take small fish with the same readiness as he will worm and paste; a fig or berry on the surface; or a frog on the bottom; leaves and scum in a still backwater; small birds or birds' eggs; lizards, locusts, flying ants, weeds and small fish. He will even de-tick an animal lying in water. The best and most convenient bait is the artificial spoon, which should always be the first course on the menu when fishing for him, unless, of course, it is known that he will not touch spinning bait, as is the case in some rivers. Persevere with dead or live bait and if these two produce no luck, then try baiting a rapid with paste balls and fish with a similarly baited hook, the same applies to gram or fig berries. I have known of mahseer waiting under bridges over the Ganges canal near Hardwar, for young martins to fall out of their nests. A 40-pound fish was caught in this way. Eggs we will leave aside, because of the difficulty in mounting; flies, locusts, green caterpillars, etc., are easily fished with, and well known.

5. *Power of Jaw.* It is difficult to realise the crushing power of a mahseer. I have had a 3-inch copper spoon (one-eighth of an inch thick), and the treble crushed in a more convincing manner than if it were done in a vice. His teeth are located in the throat well back, and inlaid in rolls of muscle. Cutting out the teeth, convinces one of where the strength lies.

I am inclined to believe that the damage is done by the teeth and not in the mouth chamber, as is commonly supposed. I am opposed to Thomas in this, but in defence can only quote two instances. In the first, I found the tail treble crushed, while the fish was hooked by the top treble of my mount inside the mouth. The throat was cut and bleeding, and the crushed treble had on it the white leathery lining of the throat. This was an 11-pound fish.

The second instance was when I found the tail treble broken off and in the throat, the fish being hooked by the top treble. This was a 21-pound mahseer, the treble was one of Hardy's improved types, and was bent out of shape. If the damage was done by the lips or in the mouth chamber, as stated by Thomas, and generally believed, broken and bruised fingers would be common among fishermen and anglers: whereas the professional fisherman will readily put his hand down into the mouth of a fish (mahseer) to extricate a hook, which he would hardly do if these powers were in the mouth. I have never myself experienced a bite or met anyone who had. A horny pad on the roof or floor of the mouth would surely be provided by nature, were these phenomenal powers in the mouth. Dr. S. L. Hora writes to me on the subject as follows:—

'In the case of Cyprinoid fishes, the pharyngeal teeth are developed as a compensation for the loss of the teeth in jaws, and for this reason they perform all the functions of the ordinary teeth of fishes.' (See *B. N. H. Journal* xli, pp. 790-94).

6. *Spawning*. Spawning is done two or three times in the year, chiefly during the monsoon, and just before, when the snow water comes down.

In April 1928 at the confluence of the Mali and N'Mai river in Burma, I took, with a friend, nearly 1,200 pounds of fish, and the majority were full of spawn.

Different rivers though have different periods. Spring-fed rivers are probably later and not until the monsoon sets in properly. Fish then work up the smaller streams, and deposit their eggs. Mahseer are not always edible during this period, and cases of poisoning or colic have been recorded.

Dr. Hamid Khan, Ph.D. (Cantab), writing in the *B.N.H.S. Journal*, Vol. xli, No. 1 dated August 1939, under the heading 'Study of the sex organs of Mahseer', deals fully with his collection and study over most of the Punjab rivers of mahseer throughout the year, and his conclusions, based on careful observation, would certainly indicate that in the Punjab anyway, mahseer have been found gravid three times in the year. His own words sum up the position fairly conclusively:—

> 'There is thus strong evidence to show that the mahseer spawns more than once during the year. Most of the Indian Carps, such as *Labeo rohita, Labeo calbasu, Cirrhina mrigala, Catla catla* and others spawn in June and July when the rivers are flooded with the monsoon rains and lay their eggs in one batch once in the year (Hamid Khan, 1924). The Mahseer, however, as a study of its sex organs reveals, seems to spawn *firstly*, in winter, in January and February, *secondly*, in May and June, when the snow melts and the rivers are swollen and *thirdly*, from July to September, when the rivers are flooded with the monsoon rains. It is for this very reason that fry of the Mahseer of all ages is seen during the whole of the year in the hill streams of Kangra, Hoshiarpur, Jhelum and Rawalpindi Districts.

> 'There is, however, hardly any evidence to corroborate the views of Thomas (1897) that the Mahseer lays its eggs in batches, "just as a fowl lays an egg a day for many days." The simile does not appear to be appropriate, as in the case of the Mahseer all the eggs contained in the ovaries seem to be laid at the spawning time and the ovaries become empty. At the approach of the next spawning season the ova reappear, increase in size, swell the ovaries and are laid again. It may, therefore, be said that the Mahseer does not lay its eggs in three batches, but that it spawns three times in the year, and that all the eggs in the ovaries are laid in each spawning season.'

This might well be taken to represent the conditions of the other river systems in India, which are snow fed, or such spring-fed rivers that join these larger rivers in the hills. The conditions in the case of the smaller rivers that are not influenced by snow water, and have to flow long distances over the plains before joining these rivers, will need further elucidation, and I think some variation may be found to exist.

Though the mahseer is essentially a bottom feeder, his special choice being among rocks for stone loach, and shell fish, he will take below and on the surface, whatever dainty morsel is in season. I have seen them under a fig tree, almost jump out of the water to take a fig as it touched the surface; so when fishing for him, exploit all means and depths before abandoning your efforts with the poor assurance that fish are not on the feed.

7. *Method of taking bait.* From what I have been able to study of the Mahseer taking a spoon or small fish, they will either surprise it from below, or follow from underneath turning over the bait as they take it.

That small fish come to the surface, as soon as a big fellow is signalled, partly substantiates this. I have also seen a fish take up a position in a small cove and dash out at passing fish with the same up and round movement; this also partly accounts for fish getting foul-hooked so often in the face, the hook catching them as they pass over the spinning bait.

Whether I am right or wrong, it was my belief in this that caused me to devise a special form of mount,—a small treble on top and a larger tail treble. The head treble I find, invariably hooks the fish, if it is hooked outside the mouth. I think also, that a mahseer takes or tries to take a bait head first, as a snake takes a frog or rat. This would also account for the smaller hook fouling the fish outside the mouth, the trace obstructs the fish taking the bait from the front end, and in failing as he turns over it, he is hooked in the cheek. I have often experienced fouling a fish with the hook shaft running away from the mouth, and the tail hook wrapped under and fast under the jaw.

8. *Spoon versus other lures.* Before we consider bait, let us first of all be agreed on the object of the bait. It is to attract and deceive. I have dealt in a previous chapter on the fish's senses, as I understand them, that is that he is attracted to the lure by the vibrations set up, that he has detective rather than sharp vision, as a secondary organ to his feeling, and to these two senses we may add taste or smell, as he is well equipped with barbels.

How does the spoon fit these two points of attracting and deceiving, as compared to dead bait, plug, spinners, etc.?

The spoon of the Myitkyina type, certainly sets up more pressure waves than a dead bait, as it spins faster, and is not as well adapted in shape to the water as the dead bait (Fish), so setting up greater pressure waves of a kind, the roughly hewn scale effect, on the convex side, must give additional aid in the water much as the teeth of a saw, in wood. The plug has a greater displacement than the large spoon, but has not the action or disturbing factor, in the water. The plug's superficial area, though slightly larger than that of the spoon, has considerably less bearing surface, so that the action in the water is reduced. The whole surface area of the spoon grips the water and revolves, whereas the diving shield on a plug is only half an inch square approximately, and in the jointed types the rear section has about as much again. Spinners have even less than the plug. So that in 'Attracting', I am inclined to the belief that the spoon covers a greater range, and would register to a fish at greater distances than the other bait under consideration.

We now come to the second point, 'Deceiving'. Here the other two senses of the fish come into play to a greater extent. In a close-up vision of a spoon revolving, a fish is able to see no more than we can, probably less, as the sharpest perspective the eye can take in is, I believe, at one-fifth of a second. So that a spoon revolving fast, retains its deceptiveness to the eye of a fish, though the chemical senses of taste or smell would be to the fish's advantage and consequently against the spoon; but in the case of the plug the main portion is stationary in the sense that the body maintains the upright position with the hooks below, and consequently does not deceive the eye to the same extent that a fast revolving spoon would, the detection of the chemical senses is the same in both cases, but the hooks on a plug are not revolving but dangling from the body of the plug, and would show up if carefully scrutinised, and then as we must suppose a mahseer cannot recognise a treble hook as such, he may reasonably be expected to take it to be a pectoral fin—if he is as inquisitive as all that!

The hooks on a spoon revolve with it. The spinner shares the advantage of the spoon in moving around its own axis, though not as fast. So that on the points considered so far, the spoon would seem to have an advantage over the plug and spinner, and the spinner a slight advantage over the plug, but the important point of how the action of each, in water, is conveyed to a fish, remains unsolved, and it is probably that in this the plug has its main advantage, though this is only surmise on my part.

As has been pointed out previously fish are near sighted, so in fast water a mahseer has not much time to examine the bait, therefore each of these would give results; but in the slower water of pools and runs a fish is able to be more fastidious, and this is why dead bait is so much more killing than the other baits, as the chemical senses must be the fish's convincing factor, unless of course there is competition in a shoal, when the boldest fish takes first. So that considering the spinning baits on these lines, I am left convinced that the spoon is the best lure, unless of course we know the fish of a particular river will not take it. But for the supporter of the Plug Bait, I reproduce a note by Capt. Franklyn Stonham, I.M.S., who has very definite views on the merits of this lure, based on the excellent results he has had in the Donn and other rivers.

Plug baits for Mahseer by Captain Franklynn Stonham, I.M.S.

9. 'There is now little doubt that the plug has come to stay as a favourite bait for mahseer and other Indian fish. Not only has it "caught on" in the river round the Dehra Dun district but I have had reports of its success in Ceylon, and in other parts of India. Its advantages should be at once obvious. Its action in the water is the closest imitation of a genuine fish that has as yet been devised, and as the majority of plugs are lighter than water and only dive when pulled, they are seldom lost. The wriggling action in the water effectively disguises the hooks which are sent into vibrations, and the fact that they do not "spin" or rotate renders anti-kinking devices superfluous and besides there is very much less wear on the lines.

'There are many makes of plug to be had, many types, and many finishes. For mahseer I find the finish is of minor importance provided that it is a natural scale finish. Those painted in more freakish manner such as white body and red head do not appear so attractive and to be a little dogmatic I may state that what I have found the best colours are Natural Perch, Natural Pike, Golden Shiner, Red side Scale, and Green mullet, the latter two being my favourites. I have tried almost every conceivable type of plug and both from my own experience and that of my angling colleagues I consider that the "Pfluger" Pal-o-mine stands supreme. It is beautifully finished, the hooks can be easily changed or renewed, a very important point, and it darts through the water with a most convincing slight wriggle, close to the surface, and exactly mimics a *chilwa*. Remember that when mahseer are "taking" they are feeding at or just below the surface, and the old motto slow and deep for big ones in no way is generally applicable to mahseer fishing.[1] Next to the excellent products of Pfluger I would place the Heddon Company's "River Runt". This has the same advantages of Pfluger's Pal-o-mine, and is even more beautifully finished and can be had of translucent material. However, the diving plane is difficult and they have some tendency occasionally to come out of the water. I do not think that the jointed plugs have much advantage over the straight ones except in quieter water and if they are not kept dry after use there is a slight though definite tendency for the wood from which they are made to crack. I almost invariably use the largest size, i.e. the 4½ inch Pal-o-mine as small fish are not averse to tacking so large a bait, and I have taken mahseer as small as one pound on them, and besides they are easier to cast being heavier. The sinking type of plug such as the "Live Wire", "Neverfail" and "T. N. T." minnows are good for occasional use in deep still water, when the fish are not rising. They have all occasionally brought me success.

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[1] I am afraid I cannot hold with this view, and unless he fishes deep in some of the great rivers and pools of Burma and Assam, the angler would be destined to failure.

'A most important feature about plugs is the hooks. Those fitted to most American plugs are not quite strong enough to be relied upon for heavy mahseer, and after trying many varieties I find the best type to be those put up by Pflugers as "Extra strength" size 10 tinned trebles. The conventional mahseer treble is not such a good shape and unnecessarily heavy. They upset the balance and movement of the plug and besides their absolute rigidity results in a greater tendency for the plug to lever them out of the mahseer's fleshy mouth. The hooks fitted to some plugs of English manufacturers are far too small and besides the British firms so far do not seem to get the hang of plugs at all.

'Plugs can be fished on any kind of spinning tackle, but their main problem is their extreme lightness, as the largest size only weighs 5/8—3/4 oz. according to the type used. If the conventional type of heavy spinning tackle is employed a weight may have to be added to the trace which is not desirable as it has a tendency to make the bait go too deep and it interferes with its action, besides the risk of fouling the plug on the bottom, especially if one has an overrun and losing it. This practically never occurs if no lead is used. Overruns are fairly frequent if one attempts to cast light baits with heavy tackle. I have now completely abandoned the two handed rod in favour of what is known as the American bait Casting rod. These rods are conventionally about 5-5½ feet long and a standard 5 ft. rod weighs only about 5 ozs. For all ordinary mahseer fishing such a rod is quite heavy enough and I have landed mahseer up to 45 lbs. quite easily on a 5 oz. rod. I prefer however to use one a little more powerful when I expect heavy fish so tnat I can play them hard as I usually like to play the fish against the maximum amount of drag I think the tackle will stand. For that reason I use a rod of 6½ ozs. to 7 ozs. 5½ ft. long which is, I think, perfectly adequate to land any mahseer. Using a rod weighing 6 ozs. 1 dram I once landed a 50-lb. fish in less than twenty minutes in heavy water.[1] For heavy mahseer I advocate the use of a "Norka" reel carrying 200 yards of 24 lb. test braided silk line such as "Lignum Vitae" or a "Nonpareil", and for lighter fishing I recommend the "Supreme" reel with 200 yards of 12 lb. test line.[2] The trace should be one ft. of fine cabled steel or phosphor bronze wire with a "Cooper" or "Stronghold" snap, which works like a safety pin, to attach the bait, and a "Lyons" ball bearing swivel to attach the line to. The ball bearing swivel will always revolve no matter how hard it is pulled on, and though not essential for plugs it allows spoons or spinning baits to be employed as well if one wishes, and only one such swivel is required. Solid wires are not to be recommended for traces as they may very easily break if kinked, though fine stainless piano wire exhibits this tendency to only a minor degree, if one wishes to make up one's own traces. Solid wire can be twisted to attach it to swivels, but cable wire must be soldered, taking precautions not to let the wire become overheated by too hot a soldering iron.

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[1] I think an average on fish over 20 lbs. would break this theory, and toy tackle would be next to useless for negotiating the really heavy water in most of the larger rivers in India and Burma.

[2] I have quoted instances in this book, where 200 yds. of line has proved insufficient for the large fish, and 150 for light and medium fishing.

'The advantages of one-handed casting are numerous. The tackle being very light in proportion to its strength, may be used all day without the slightest fatigue, which is a very decided advantage in hot weather. If one becomes proficient in over-head casting it is extraordinarily accurate, and using the reels mentioned above casts of thirty to sixty yards can be made with a little practice. The reels are multiplying and the plugs can be moved at any speed, and can be even cast upstream and worked down with a strong current. The multiplying action saves much of one's energy and is of the utmost advantage in playing a fish as slack line can be recovered almost immediately. Braking is done by thumbing the spool and is semi-automatic as a sudden rush on the part of the fish pulls the rod down and moves the reel away from the thumb, and besides this thumb pressure can be finely graded. Another very great advantage is that the rod can be held and the fish can be played *entirely with one hand,* leaving the other hand free to assist oneself climbing rough banks, or wading strong water without the aid of a cooly, and this feature is also an advantage if one wishes to gaff the fish oneself.

'This type of tackle has been frequently criticised because it limits the length of the trace. My experience leads me to the conclusion that there is not the slightest disadvantage in a one-foot trace.[1] One only needs the trace in the event of a fish with teeth, such as a goonch, being hooked, and to obviate the risk of the hook points accidentally fraying the line. Otherwise it is open to question if a trace is necessary at all, as the dull black colour of the two lines mentioned above makes them no less invisible than any ordinary wire trace. Another criticism is that these short rods do not allow the line to be lifted over bushes. This argument does not bear closer examination as the rod can be held high above the head and the fish played, and besides this, there seldom are any bushes close to a mahseer stream.[2] In fact, there is often no vegetation within several hundred yards of the water except when it rises during the monsoon. One disadvantage is that weights of over 1 oz. such as a chilwa on a spinning mount are not easily cast with one hand as neither the rod nor one's muscles will stand up to the strain, and for such heavy baits a two-handed rod is better. Still when one is accustomed to plugs one seldom wants to use chilwa.

'Lastly, let us consider the reel. For this style of fishing the level wind anti-backlash multiplying reel is to be preferred. They are all American and many makes and types may be obtained. The only British example I know of, though an excellent reel, has too small a line capacity to commend its use for anything but light mahseer fishing. These reels are entirely automatic and do not overrun but they are complicated and are easily put out of gear by careless use. They require constant attention to give good service. The level wind mechanism is the most vulnerable part in dusty India and must be frequently oiled and cleaned. Still if one is careful with one's tackle they give long hard service. On all the better ones the bearings etc. are adjustable for wear and the level wind pawl is supplied in duplicate and this spare is built into the reel, other spare parts are standardised and can be obtained from the makers if ever required. If one buys one of the better types and looks after it, will give almost unlimited trouble—free service. I have used a Norka solidly for four seasons and it is still as good as new. It casts baits from $\frac{1}{2}$-1 oz. admirably, but the smaller reels work well and give satisfactory length casting even less than $\frac{1}{4}$ oz. provided not too heavy line is used.

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[1] In this connection I have expressed my views freely elsewhere.
[2] I think this view is also a questionable one; in some rivers certainly.

'In conclusion I may state that in my opinion the heavy two-handed rod and many of the methods now employed in mahseer angling are doomed to early obsolescence, and the short light rod and light tackle will appeal more strongly to anglers if only from their sporting features. These rods can be obtained made entirely of steel, and the superior grades of these are delightful to use and besides they are quite unaffected by climate.'

10. *Spoon bait and scale effect on spoons.* It is difficult to explain what a fish imagines a spoon to be. I am reluctant to say he thinks it a fish; and it is a perfectly logical assumption to think that he, like most creatures, has a certain curiosity for new things, catches it with his mouth, as we would with our hands, and so comes to be hooked.

Mahseer prey more on sick and damaged fish, or small fish at a disadvantage. A spoon may present a likeness to a wounded or sick fish, but I am afraid I can see no resemblance to a healthy fish more especially in still or slow running water.

In a rapid it is quite another matter, for a feeding fish is an opportunist, and has no time to inspect a spoon dancing about in broken water. He darts out and takes it. This is substantiated by watching a fish in a pool while trolling. He will come up and even follow a spoon; change over to a dead bait and he takes it, which might be the work of the barbels on the mouth, referred to by fishermen as 'coming short'.

In the case of scale-marked spoons, I found I never had a blank day, when every other kind failed; and with them I was, in 23 days, able to catch 800 pounds of fish, the best being 75 pounds and then after having worked through many kinds and varieties. Try a spoon similar to the Myitkyina type as shown in the chapter on 'Tackle', get it to spin any speed in water below you, and see for yourself whether or not the scale effect shows up.

11. *Hen fish attain greater size.* Fish, like falcons and eagles, appear to reverse the general laws of nature, in that the hen fish (spawner) attains a greater size than the cock fish (milter). It may be a provision of nature, to assure that the spawn of a hen fish can always be reached by the cock fish when she migrates up into small

streams. If the tables were reversed it might be possible that the cock fish through his size, could not always get where the hen fish selected to deposit her eggs. Only a surmise on my part, and an assurance to my own curiosity!

12. *Fishing for mahseer*: *Spinning.* I will start by assuming that the angler has now learnt the use of the tackle, can cast a bait, has seen to all the important factors of the reel working well, the joints of the rod firm, the trace correctly attached, the spoon bait and lead mounted, and the end of his line tested.

13. *Where to look for mahseer*: *Rapids.* The rapid will provide the best sport for spinning, as feeding fish invariably collect in the 'bottle necks' where small fish are to be had at some disadvantage. Small fish will collect in the quieter water of rapids, that is in 'feathers' behind rocks; in the eddies and swirls by the edge of the fast water; or below falls where the force of the water is broken, affording them temporary rest from the fast rushing water of the main current. So that generally speaking this is the water we should consider and work thoroughly.

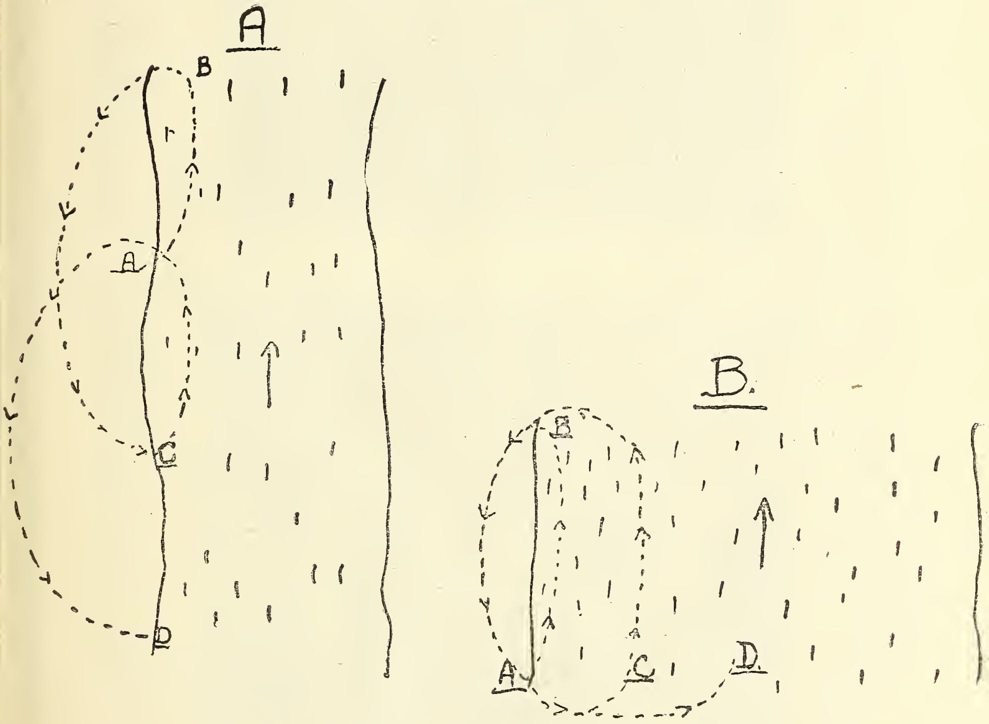


Fig. 1.—Start at 'A' and work down to 'B'; then come around to 'C' and work down to 'A' and up to 'D', and so on in each case.

Just above runs are spots where the water flows deep and strong, and where it gathers itself for the final plunge down the rapid. This is smooth and oily looking and should always be tried.

Before starting to fish take stock of the water, and look for movements of fish, gulls, kingfishers, etc. Make a mental note of the likely places and number them off in your mind. Tackle each in turn. If the rapid is long and narrow quarter it off in your mind and fish each section thoroughly, starting from the top of the section each time. See diagram (A) overleaf.

If on the other hand it is a wide and shallow rapid, and allows wading, quarter it off and wade in so many yards at a time, and work each section thoroughly. See diagram (B) overleaf.

It is a sweat sometimes, but I assure you it pays. Work the edges first, then move in at suitable distances, and work down as far as you can. When you are taken or you move a fish fix the point in your mind at once by setting two points on the bank, a tree, boulder or brush wood, for future use and reference.

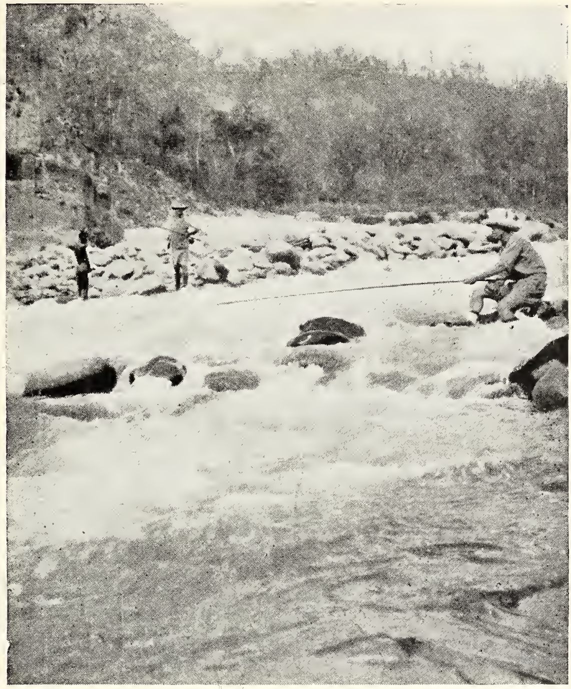
Work all the water in a rapid from the head, where it breaks over stones and is shallow, to the point where it 'fans' out in the pool. Fish will take anywhere in such water, give the 'white feather' behind rocks and boulders special attention, and the 'V' formed by the fast and reverse water; work these as quietly and with as little disturbance as possible. If the rapid is large, and a boat is necessary, follow the same procedure. Have the boat held at intervals to allow you to fish all the likely water, then move up or down ten yards or so and repeat the operation.

A very good tip and one that frequently pays with dead bait, is to allow your bait down the rapid by degrees, past boulders, swirls and eddies, very often this attracts fish lying at the side or behind a submerged boulder. In fact, wherever the water is fast and narrow, flowing over large boulders, it is a good plan to fish it in this way first, or wherever the water does not allow of casting and spinning, owing to the narrowness of the run, or the 'boil' being under a large overhanging rock, or the many other similar conditions met with. Allow the bait to play about in such water for a minute or two, then move it down to the next place and so on. Very often it also pays to pause awhile after wading out into a rapid as, however careful, one is sure to disturb the water and be detected by fish. Allow the water to settle down and get used to you, so to speak, so that the fish too will be assured that you are just part of the rapid. It is most extraordinary how this pays, and how fish will almost bump up against you, if you keep perfectly still.

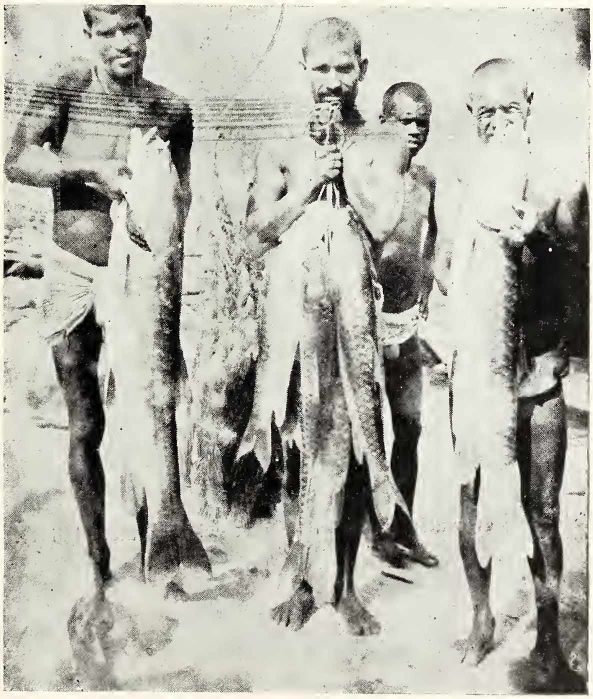
14. In order to simplify these notes, I have included a sketch of a mile of ideal water and lettered the best places, to look for fish.

The map is taken from my log book, and illustrates water likely to be met with in most hill rivers (*vide* reverse of adjoining plate).

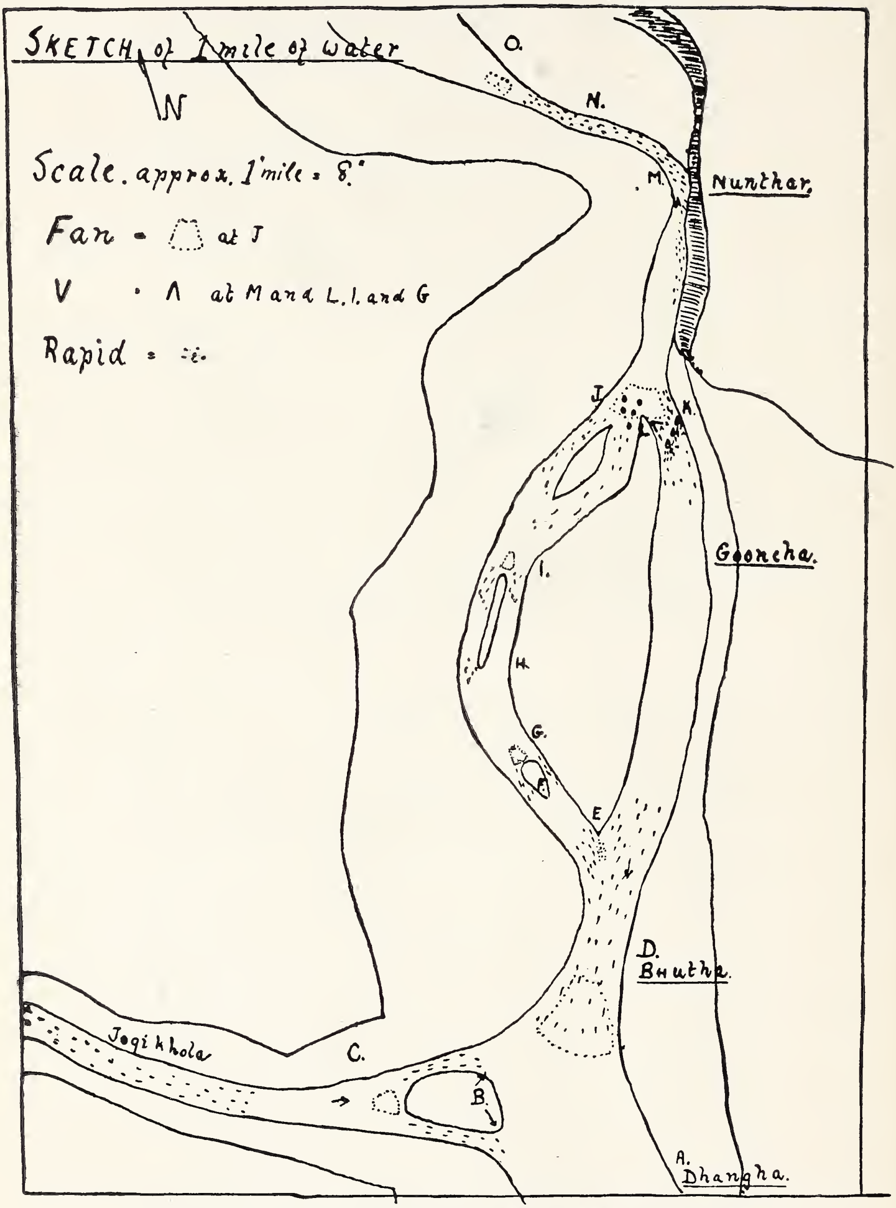
(A) Is a large pool, 600 yards long, by 600 yards across with 30 ft. of water in the deepest parts. It is the first pool below where the river leaves the hills, always a good place if sufficient protection is afforded by boulders. Trolling across from where the Jogi Khola joins (below and above would be likely water), also up the right bank, where the still water has banked up below the junction at (B).



'White water' where large fish are usually taken.



Part of a bag taken in the rapid shown above. Two best 30 and 25 lbs.


SKETCH of 1 mile of water
N
Scale. approx. 1 mile = 8"
Fan = at J
V = Λ at M and L, I, and G
Rapid =
O.
N.
M.
Nunthar.
J.
K.
Goocha.
I.
H.
G.
E.
D.
Bhutha.
C.
B.
Jogikhola
A.
Dhangha.

Sketch map of water likely to be met with in most hill rivers.

(B) The junction is not very imposing, the Jogi Khola has about 2½ ft. of water, where it runs over shingle into the main river, and falls over a steep bank abruptly into deep water. Below such banks, and in the quiet water between the two channels, usually holds fish, but it must be approached very carefully, and is best fished from the island.

(C) Is the 'fan' which is almost without exception good if boulders are present, as in (J). This is water *B. bola* (Indian trout) love, and I never failed to take two or three each time I fished it.

(D) Is the best rapid in this stretch of water, from the junction of the two channels to the 'fan' into the pool, about 40 yards short of the junction (B). It is fast water over large boulders 5 ft. in diameter, with the main current about 40 yds. across and 10 ft. deep, shelving to the sides for about 20 yards where the water is 3 to 5 ft. deep, permitting wading. This is excellent water for big fish.

(E) The point at the junctions of two streams, generally has a 'ridge of boiling water running out for some distance, caused by the banking up of the lesser streams by the stronger. This is generally a certain find for feeding fish. If the water is deep at the point, it should be fished from above, and the spoon or bait allowed to work down. Work all the water from the actual point to where this boil disappears. Fish will take anywhere in such places.

(F. H.) Are modifications of (E), and should be fished in the same way. It is light water 4 or 5 ft. deep with boulders dotted about, and about 25 yds. wide. Best worked from (I) through (I), (H), (G) and (F), first from one bank then, after a rest, from the other, keeping the sun in front of you and wading in where necessary. It is ideal fly spoon water. The 'fans' at (G) and (I) should be approached from above in each case.

(G. I.) Are 'fans' falling away into small rapids on either side of the island, and are best worked from the banks and above.

(J) Is an ideal 'fan', defined by dotted line, and a certain find for fish, having plenty of 'feathers' behind large boulders. It is 50 yds. across, 3 to 5 ft. deep, and connects the two large pools Gooncha and Nunthur.

(K) Is 'white water', broken up by three huge boulders, forming 'feathers', and falling 5 ft. in as many yards. This is big water.

(L) This is a 'V' formed by the reverse water and rapid, (marked in with a 'V').

(M) Tail of rapid starting at (O), into deep pool below cliff. This is also a 'V', with slow water tailing into the pool.

(N) Deep very fast water, narrow and deep over large rocks or slabs of sand stone.

(O) Similar to (J), but without 'feathers' or boulders, running in a deep narrow channel over shingle.

Gooncha and Nunthar are both huge deep pools, ideal for fish, The former is rocky at the head and sandy at the tail, the latter runs along a cliff, very deep with huge slabs of sand stone dotted about at intervals.

15. *Pools.* The water in a pool may be still and glass like, or slow moving with odd swirls caused by out crops of rocks, shallow banks, bays, etc., so that I can only refer my remarks in a general way to the most suitable water.

The really big fellows will usually be taken in the pools by fishing deep and slow, with a dead bait or spoon. I myself like to work a trolling bait diagonally across a pool, so that the bait is carried well below the boat, and at least 20 yards or so away. Work all likely water near rocks, swirls, over boulders, and along the edges of the flowing water formed with the still back-water where you will generally find froth and foam collected. Best of all is the tail of the pool where it shallows down, and just before it starts to flow down the next rapid.

16. *How to work water.* The following diagram shows how to work a promising bit of water. Vary the length of cast each time, if possible, then move up or down stream, and repeat the same system of casts.

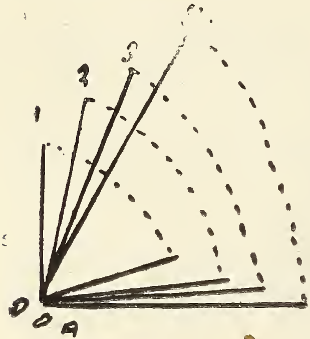


Fig. 2.—

The Cast A is the position of the angler—(1) is the first cast, (2) the next and so on until (4). These are made out and into the rapid at right angles to the bank. Allow the bait to swing round and below you before winding in. Feel the spoon all the time it is making this arc of a circle through the water, as this is when one is usually taken. Try to reel in your bait up the side through swirls, by rocks and where the reverse and rapid water meet. This and behind rocks, is where big fish mostly lie when feeding.

17. *Known water.* If you are fishing water that is protected by a club, and a log book is kept, the first thing to do and before you assemble your rod, is to study the notes and any sketches there may be of the water you are going to fish. Jot down as many of these as necessary in your pocket book, locate the spots and always tackle the best water first. If it is a rapid, you should start at the bottom, if you want the big ones.

The larger the fish the lower down he lies in the rapid, or he may be at the head of the pool, usually where the rapid tails into it. If you are on a new piece of water, of which you have no previous information, try to get out the evening before to see where fish rise.

Fish lie with their heads up stream, and bait-spoon or natural, cast up stream, is often more successful than casts made across or down. Method has to be suited to water conditions, and for these directly up-stream casts, reeling in has, to be more rapid, and a mutiplying reel is an advantage, almost a necessity.

There are always back-waters on the edge of rapids, and the water works round in a circular movement, in the opposite way to the current. Sit and watch from some convenient spot or spots, with the assistance of an attendant if necessary, each taking a section of water, to observe which looks the most promising. As the sun is beginning to set, you will usually see mahseer rising over the best places.

18. *How Mahseer rise.* They rise much the same as the dolphins and porpoises in the sea or large rivers, and are easily distinguishable. Their hog backs come right out of the water; but it is not always that you will enjoy such delectable sights. In many fine rivers the fish are not seen, or their presence known, until the reel screams out its music.

Try all the good looking water on one side, before attempting to fish the other. It is always owing to that spirit of adventure which is in us, that the further bank is the better one. The rapids, if shallow, are best in the morning and evening, and the deeper quieter water during the day.

Fish deep and as near the bottom as you dare, and don't be satisfied until you have felt it once or twice. If however, you are losing your tackle each time, take off the hook mount, and survey the bottom with only the lead and spoon. Get the hang of your water in this way and then fish deep where you dare, and shallow only where you must.

Some of the water is so deep in Burma rivers, that I know of a most experienced angler, who has caught some large mahseer of 70 and 80 pounds, who used to count ten after a cast with a 4-oz. lead on, paying out line the whole time before he started to wind in his bait.

I am convinced that this is the secret of catching the really big fellows. Let us consider our grandparents and their lack-a-daisical mood. They are not moved by the latest hit in the town, to which the young 'bloods' flock. They are quite satisfied to sit in an easy chair and take the news and diet that is served on them, with as little trouble as possible to themselves. This is how I reason also for the grandmother mahseer. If you put your spoon near her into the depths, she will take it, otherwise she will let it go to the younger and more active fish.

19. *Monotony of one bait.* Here again if you strike or lose a fish at one spot, do not go on hurling your spoon at him the whole day. You know what poached eggs daily for chota hazri taste like? You are not altogether kindly disposed to the servant! A fish with a torn or hurt jaw is going through much the same feelings, if you continue to serve up the spoon from which he has just escaped! Rest the water and come back to it in a couple of hours. Remember your fish—the real big one—is generally a hen, and extend the psychological factor to our own kind. Women are ever inquisitive and easily caught, change the fashion in spoons, and hope the fish, like women, will bite!!!

It has been my experience when fishing, that as long as one lands the fish one strikes one can keep on fishing the same spot with success, but as soon as you run and lose a fish, they seem to go off the feed. Whether they have a means of communicating danger to each other or not, it is difficult to say.

Let me here draw an analogy of the human ear and the lateral line of a fish. It is possible, that as certain sounds have adverse effects, such as the soothing sound of music or the irritating yapping of a dog, or child crying; so, vibrations set up by the different lures, may have similar reactions on a fish. Which are soothing, and which are annoying or alarming, is what the angler must find out for himself.

Remember these three big points when playing a fish.

1. Point of rod up.
2. Line always taut, and
3. Play a fish off the reel and through the rod.

20. *Point of rod.* The moment you are taken, and your reel screams, the first action should be to raise the point of your rod, as high as you can, or give him 'butt' as it is called. This puts both pressure on your fish as well as saves your line slacking, for even that fatal second. It also serves as an indication of when to reel in, for you will soon learn how the rod is forced down, and your arms pulled almost straight, by the first mad rush of a big mahseer. It is at the end of the rush that the critical time comes; for if the line is the least bit slack when the fish turns, the chances are that you lose him. This is the commonest and easiest fault while playing a fish.

By playing the fish off the reel and through the rod, I mean to imply that you should not use only the one or the other. If you overbrake your reel, you are putting all the strain on the rod, and likewise, if you point the tip of the rod in the direction of the fish, you are direct on the reel, and you lose the whole advantage of the rod; compromise between the two and you get the correct pressure; if your reel is large enough, and takes 300 yards of line, you can rest assured that you have enough line for the largest mahseer. Don't brake a reel or foul the handle of the drum while it is revolving. You will come to grief if you do; just study what you are doing. With a brake on you are unable to gauge what pressure you are applying, however expert you may be, and by putting your hand in the way of the handles, you are sending out a succession of jerks which go down the line to your hook-hold, and furnishing the best way of releasing your fish. We all know what it is like to pull a firm peg from the ground by gentle pressure, but a few taps and it comes away. Exactly the same applies to the hook hold, and what your hand is causing to the fish's mouth by fouling the handles.

21. *Selection of water.* I am a firm believer, when on a short holiday, in sticking to a piece of water you know is good, rather than spending a week of leave by exploring new places; but if one has plenty of time on hand look for new water every time.

22. Lacey's *Angler's Hand Book,* gives the figures of his luck, through a career of fishing for mahseer, and these are interesting, as he must have kept careful notes. He works it out over 10 days, in the following way (Inserted from Lacey's *Angler's Hand Book*).

'I do not wish to discourage the beginner, but to take an average all round, say that out of ten days steady fishing, taking rivers and seasons about, the angler will, as a rule, have 5 days blank, 4 days on which he will have perhaps, moderately good sport, but the tenth will be the really good day, which should make up for all the rest.'

The above is an average, and such has been my own experience while fishing exclusively for heavy fish. I thank that 7 days out of ten, good fishing can be had with fly spoon, and something on the other three.

I like to reason this subject in the same way as heavy mahseer fishing compares with big game shooting, and light fishing with the 'scatter gun'. In the first place blank days are to be expected; we do not get every tiger that kills, or every bison or tsine we track, but seldom do we go out with 'scatter gun' or fly rod and not get something.

I give as a matter of interest, the log for my last seven trips which are representative of the average river. (See p. 54).

As will be seen no exceptional days were experienced, as is sometimes the case when the small fish are running or the large fish are collecting. My companions on these trips were, with the exception of two, all new to the sport, so that we may justly conclude either that sport is better than it was when Lacey wrote his book *The Angler's Hand Book* or modern methods are proving more successful.

23. *Wade cautiously.* Movement above where fish are feeding, causes some disturbance and displacement both of water and gravel while wading. This is connected with some unusual occurrence to fish, and they become alert. The hungry fish will look for food, the shy fish for danger. Adapt your methods to meet both cases.

24. *The element of luck.* It remains a mystery why on one day fish will feed ravenously, and the next day, (though even to the keenest observer both days appear identical) not a fish will move. Time in trying to study the causes is never wasted, and notes made, such as temperature of water and other cognate matters, always assist one. I have had equally good luck on cloudy and sunny days, windy or still days, and even thunderstorms have not disturbed the fish. They have their feast and fast days, as we have ours, but the reasons for this are what every angler should try to elucidate.

25. *Water and temperature.* Unlike the English fish, the mahseer will take in gin clear water, in fact the clearer the better. Do not despair if water is running dirty; quite often fish will take a spoon in water so discoloured that you cannot see the bottom in a depth of 12 inches. If you know the water it helps, as fish will generally be found in the same places as when the river was clear. I have taken fish with spoon in water a companion of mine refused to fish in. After all, if the lateral line has the function we attribute to it, why should a spoon spinning in a good spot, not attract a fish? Dead bait used the same way is also effective, and here suit your methods to the chemical senses. The functions of the eye in clear water, are replaced by those of smell and taste in discoloured water.

The temperature of water has its effect on fish. When the water is cold the river will seem quite lifeless. Falling water has its supporters, but I think we are, comparatively ignorant of the 'whys and wherefores' of our scaly friend's capricious appetites. Study good days as well as bad, both are equally important. Do not fall into a groove of supposition that it is useless to fish at any time,

SUMMARY

Date	Locality	Fish	Weight	Average	Rods	The Day's Best Bag	The Day's Best Fish	Best Bag in Pounds	No. of Fishing Days	Blank Days	Percentage of Successful Days.	Remarks
11th April to 8th May 1928	Mali H'Kas Burma	53	861½ lbs.	16·25 lbs.	1	50, 42, 1 34, 18½	75 lbs. 40 lbs.	145½ lbs.	28	12	57%	Practically all the time was devoted to heavy fishing.
4th April to 8th June 1935	Sarju and East Ramganga Kumaon U.P.	207	870¼ lbs.	4·3 lbs.	1	36, 30 7 lbs.	96 lbs. Goonch	73	50	16	68%	Fly spoon and heavy rod used equally.
10th to 27th October 1937	Nepal	28	274½ lbs.	9·8 lbs.	1	21, 18, 16½ 10, 5, 6, 4^2, 2^2	29½ lbs.	92½ lbs.	18	3	83%	
11th to 26th April 1938	Do.	102	558½ lbs.	5·4 lbs.	2	29, 23, 16, 9 and ten others		123½ lbs	16	Nil	100%	Mostly fly spoon, with occasional days with Spinning Rod
12th to 31st March 1939	Do.	46	207¾ lbs.	4·5 lbs.	1	13, 5½, 4½ $1\frac{1}{2}{}^{3}$	27½ lbs.	27½ lbs.	20	2	90%	
21st to 31st October 1940	Lashya Kumaon	155	142 lbs.	·9 lb.	3	21 fish	9½ lbs.	34	10	Nil	100%	All light work with fly spoon.
23rd March to 6th April 1941	Nepal	161	605½ lbs.	3·7 lbs.	4	12 fish	37½ lbs.	90½ lbs.	15	Nil	100%	Mixed work. Fly spoon and spinning.

except the mornings and evenings. More especially where streams meet, or when a river has been discoloured by rain water, the fish start to feed irrespective of the time of day, and the moment it starts to clear. They may be hungry from not having fed for three or four days, and are on the look out for food as soon as the water is clear enough to allow of it.

There is no better way of meeting the local people than to talk to them in their own homes about sport and their crops. Play the gramophone to them, dress their sores, give the children a few sweets and keep both ears open for local ideas. The primitive people, such as one usually meets on a fishing trip, are largely dependent on their wits for fish and flesh, and have experience handed down to them for generations. Exploit and adapt their suggestions and ideas, and with your own knowledge you can very soon arrive at a killing method. This recalls to me an incident at Namti in Upper Burma, where I tried to catch some mahseer in a pool just below a village by spinning; the fish would not look at my bait. An old Burman saw my failure, and as I had been there before asked me if he should collect the fish, to which I gladly assented. He then started breaking up pumpkin leaves and throwing them into the slow water, which in a short time was alive with mahseer. I attached a hook and light gut cast, and with this leaf caught seven nice fish. The village feasted in my honour and we became very good friends for ever after.

26. *Following in a boat.* Boats, if available, are the best things in which to follow fish. One can concentrate on the fish the whole time, and not have to worry about where to put one's feet, or how to climb over rocks while following down a bank. The Burmans, or better still the H'Kamti Shans, in fact all the fisherman tribes in India, are wonderful at manipulating a boat through the most treacherous water. They seldom if ever lose their heads, and have a wonderful sense of correction while the boat goes hurling down a rapid.

If, as usually happens some time or other while on a fishing trip, the water is discoloured, baiting can be done quite successfully by getting rice or flour mixed with earth or any other ingredients, such as bran, oilcake, and the more foul tasting things, bad meat etc. and fixing it into two wicker baskets, tied over one another. This is placed in a run, where the water churns up and washes it out through the sides of the basket by degrees, when it works down stream and fish move up towards it. A live or dead bait should be anchored just below the basket. This gives very good sport, if one is driven to it with no other alternative.

Dead bait fishing is done in the same manner as spinning, and does not call for any special explanation.

OTHER METHODS OF FISHING FOR MAHSEER.

27. I have dealt chiefly with spinning for mahseer, which is quite the most pleasant of all, and the way most of the large fish are taken. I have also dealt with trolling, and dead and live bait fishing.

It will suffice to say a few words on how to fish with fly, gram, and paste, which cover all the ways we know of circumventing this fish All these methods, with the exception of paste, might be considered under light fishing.

28. *The fly and fishing with fly.* A number and variety of flies are listed in the tackle books, and one must suit ones fancy to the local conditions and tastes of the fish prevailing, which is only picked up locally from experience. Manton's list 12 of the best known, and be it a 'Jock Scott', 'Blackamore', or 'Black Ranger', must be your individual choice.

Sea-trout flies, dressed with sufficiency of tinsel, the two hooks of stouter wire than the flies made for home use, are said to be effective lures for mahseer, Indian trout, Butchwa and other fly takers. They should be dressed to imitate the smaller minnows prevalent in the water being fished.

It sometimes happens that flying white ants flutter in myriads over the water affording a great feast for fish. At such a time they will look at nothing else. The fly known as 'Gibby's Ant' (A & N Stores Bombay) will then prove successful.

In rivers the fly should be used in the same way as for salmon, pulling the fly with uneven speed and occasionally pausing, giving it a chance to spread and assume a life-like movement of opening and closing. Allow the water to play it about keeping the line taut enough to enable you to strike instantly. It is also a good dodge to drop your fly in fast water passing over a steep step, and where it suddenly falls away deep, pay out line by raising the top of your rod, and then lowering it, you must always feel the line or you will miss a rise. Such places usually hold feeding fish. Striking is the same for all fish, and is made by sharply lifting the point of your rod, with the line free. A strike off the reel is good enough for the leathery mouth of the mahseer. In comparison, I think the artificial fly is an inferior bait to fly spoon; and fewer fish, both in size and numbers are taken than with a very light spoon which is made from tin foil or aluminium. It starts spinning the moment it touches the water. Fly has a traditional love attached to it, and keeps your hand in for the home fish when the spot of leave comes along. So, brother angler, weigh its merits for yourself.

29. *Gram fishing for mahseer.* This form of fishing is almost exclusively practised in most of the C. P. rivers, where the mahseer prefers it to any other form of bait.

Fish of ten pounds and under are taken in this way on light tackle, and afford excellent sport on a fine cast, and a small hook with a 9 or 10 ft. trout rod. The tackle for small mahseer is suitable.

30. *Method of fishing.* First select your water. The best places are runs into pools, waterfalls, and bathing ghats, or rocky gorges. This done the selected spot must be baited morning and evening with parched or roasted gram, and when it is thrown in to the water, especially in the case of slow or still water that is very clear, the man who is doing this for you, should be instructed to keep out of view (in the case of runs and waterfalls it is not so

important). If a suitable rock or bush be near-by, all the better, the arm too should not be flourished about in the air when fishing, but the gram flicked from the hip, with as little movement as possible. This is the most important thing about this form of fishing. If you are resident in a place and baiting can be done daily, the fish are in time educated and get accustomed to the sight of man, and will associate him with food, and little precaution will be necessary. I refer more to the visitor to the wild parts of rivers where he may happen to be shooting, and is intending to have an occasional afternoon's fishing under these conditions. Fish may collect in one, two, or four days, depending on the size of the river. When they have collected in sufficient numbers, fishing should commence. The mornings and evenings are the best, the earlier and later the better.

31. *Gram for bait.* Selected grains should be drilled with a piece of wire beaten into a spear point, and large enough to take the eye of your hook. (Special gram hooks are sold by Messrs Verona and Mantons of Calcutta). An orderly or *chaprassi* can be put on to this job the day before; carry a small tin of drilled gram in your pocket for bait.

32. *Hooks.* As already mentioned special gram hooks are offered by tackle dealers. I like Hardy's sharp loop-eyed hooks the best. They are very light and sharp and can be attached or removed from the cast in a moment, and the spring extension keeps the gram in position. Size 11 for one grain, or size 9 for two grains; the eye can be passed through the drilled gram quite easily, and the cast attached by the loop. I am against any form of metal, other than the hook, on the cast or at the joining of the cast to line. This makes your line and cast sink faster than your bait, and scares the fish.

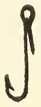


Fig. 3.—

33. *Cast lines.* Do not spare gut, and use a six foot cast of 2x. gut.

34. *Tackle.* A small Silex $3\frac{3}{4}$ inch or any other suitable reel serves the purpose. A 9-ft. or 10-ft. fly rod that will throw a small spoon makes the ideal rod for this form of sport. (Hardy's 'Perfection' or 'Gold Medal'.

35. *Other tips.* When your fish is hooked, if he makes either up or down stream, follow and shelve him, as far away from your baiting place as possible, so as not to disturb the water; for if you do not move away, he will surely return to the other hungry fish, and splashing and turning, as a hooked fish does, will spoil your sport for a time.

Before leaving the place throw in more gram, so that the fish can again feed after the scare has worked off, and the bolder fish will attract the shy ones.

Lightness of tackle and limited movements, with as little disturbance as possible to the natural elements of the water, are the three things to sum up the precautions to be taken in this form of fishing.

36. *Paste fishing for mahseer.* This covers a much wider range than the two preceding methods, and may be productive anywhere from north India to the south of Burma. It is a bait all varieties

and sizes of fish will accept. Conditions must therefore be adapted to the rivers in which one is fishing.

In coloured water, in the largest rivers; or in the C.P. rivers in the same place as gram fishing is practised, and under similar circumstances, paste will bring the mahseer and other sporting fishes of India to bag, provided the local conditions are taken into account. It is however a dull form of sport compared to the foregoing methods. I have mentioned paste in Chapter X.

37. *Baiting with paste.* This can be done along with gram, in the same places, so that when fish have stopped feeding on the surface, one may try the paste balls on the bottom, a method which generally produces carp, mahseer, or, as I have said before, perhaps any other fish or even a turtle!!

The method of baiting with *Atta* is to make small paste balls the size of Dove's eggs, and throw them in, in much the same way as gram. When you are going to fish with atta, the usual few pellets should be thrown in, to collect the fish. When you send down the baited hook amongst them, be it rapids or slow water, keep out of sight as far as possible, or if this is not possible, than as still as possible. As with all wild life it is movement, not form, that alarms.

Baiting a hook for this fishing, can be done in no better way than with paste dealt within the manner I have mentioned in the Chapter 'Scraps from my Note Book'. By boiling it it holds on to the hook, and is not washed off by the rapid water, or the small fish nibbling. I prefer a single hook to a treble, though the treble holds the paste far better. A fair-sized hook, to take a lump of atta the size of a dove's egg. Any shape of hook does, and is a matter of choice or fancy. 'Killen wire' for the heavy fish and gut for the medium-sized ones, meets the purpose. The awful snags that these C.P. rivers have, with the knife edge trap rock bottom or sides, gives a fish a distinct advantage over the angler for freedom. For attaching hooks and tying casts, see Chapter V.

For paste fishing for the very large mahseer taken in the rivers of Mysore the bait is made from 'ragi', a staple grain of Mysore and other parts of South India. This paste is strongly adhesive to the hook, and both the balls thrown in as ground bait, and those used on the hook, are the size of large hens' eggs. December-January and September-October are the best months. Single hooks, size 4/0 are used, and the turned-down eye is best. Gut or wire trace is not advisable: line should be of dark colour. No float is used: strike should be hard, to drive in the hook, as soon as the fish begins to move.

38. *Heavy Mahseer fishing.* I will conclude this chapter with a few points which require mention, and which are more especially concerned with heavy mahseer fishing.

1. This is hard work and it is only perseverance that brings reward.

2. If you want to catch the monsters you must know where to look for them, and above all, you must get your bait down to the fish.

3. Get into your mind the ideal water for fly spoon work, then

try to find these conditions in a big way, that is, instead of the rapid being 4 feet deep and 40 yards across, find one 20 feet deep and 150 to 200 yards across. Here, or in deep pools, with slow runs into them, or in bays by the side of rapids.

4. Big water wants a great deal more fishing than does the ordinary rapid. The first cast may only tickle the fish, the second draw or attract him, the third or fourth will bring him to the bait.

If your boatmen can ferry you across the smooth water above one of these rapids, and your nerves will stand it, your reward awaits you. I was taken above the 'Rocks' rapid in the Myitkyina District of Burma, three times in three tries, by monsters. I saw them in the clear shallow water (8 ft. deep), but what with having to make the bank 100 yards away, and the roaring torrent below, either my nerves gave and deprived me of concentration on the fish, or the 300 yards of line proved inadequate.

I gave these monsters best here, and never tried again as it was only asking for trouble. What tempted me to try at all was the monsters I saw rising the evening before. I camped on the bank opposite, and after showing the boatmen fins and tails, the like of which they had never seen, persuaded them against their wishes to try it. (An angler's nightmare).

In conclusion I would refer anglers to Col. R. W. Burton's article in Vol. 41 No. 4 of the *Bombay Natural History Society's Journal.* 'A Mahsir River in Southern India'. It is a complete guide to the Bhavani river, by an able and experienced angler. Also two articles by Major W. B. Trevenen 'Mahseer fishing in the Deccan Lakes' and 'Fishing in the rivers of the C.P.' (Vol. 31, No. 1, p. 120 and Vol. 34, No. 3, p. 700). A well illustrated article by Sir Reginald Spence and Mr. S. H. Prater entitled 'Game Fishes of Bombay, the Deccan and the neighbouring districts of the Bombay Presidency' appeared in Vol. 36. No. 1. of the *Journal* (pp. 29 to 66). It was written as a help to anglers in the Bombay Presidency, but contains information of interest to anglers in most parts of India. It is obtainable in pamphlet form on application to the Society.

ON THE BIRDS OF THE KAREN HILLS AND KARENNI FOUND OVER 3,000 FEET.

BY

H. C. SMITH, M.B.O.U., P. F. GARTHWAITE, AND
B. E. SMYTHIES,

Burma Forest Service,

assisted by

The late DR. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U. etc.

(*Continued from Vol.* xliii, *No.* 3 (1942), p. 474).

PART II.

711. **Lanius c. colluroides.** Burmese Shrike.

Previous records.—Karen Hills; Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♀.
Noted.—Probably breeds in these hills. Not seen at Thandaung.

712a. **Lanius nasutus tricolor.** Burmese Black-headed Shrike.

Previous records.—Karen Hills.
Specimens.—None this year.
Noted.—We did not meet with this species again.

716a. **Lanius schach nipalensis.** Grey-backed Shrike.

Previous records.—Karen Hills 4,000 feet (Wardlaw Ramsay); Taho (Salvadori).
Specimens.—None.
Noted.—One bird was seen in the tea estate at Thandaung on 11 October 1941.

719. **Lanius c. cristatus.** Brown Shrike.

Previous records.—Karen Hills (Salvadori); Karenni (Wardlaw Ramsay).
Specimens.—Thandaung 1 ♀.
Noted.—This bird appeared in the tea estate in Thandaung on 7 May as a passage migrant; others were seen on 9 and 10 October 1941.

724. **Hemipus p. picatus.** Black-backed Pied Shrike.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♀.
Noted.—Several parties were noted in Thandaung in September and October, but it is chiefly a bird of the foothills.

727. **Tephrodornis gularis pelvica.** Nepal Wood Shrike.

Previous records.—Thandaung (Cook).
Specimens.—None this year.
Noted.—Occasionally seen both on Nattaung (where a pair was observed feeding young) and at Thandaung.

729. **Tephrodornis p. pondiceriana.** Indian Common Wood Shrike.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen, except for one party on Nattaung not identified for certain.

734. **Pericrocotus speciosus elegans.** Burmese Scarlet Minivet.

Previous records.—Karen Hills; Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1♂; Thandaung 1♂.
Noted.—Common.

739. **Pericrocotus brevirostris** subsp. Short-billed Minivet.

Previous records.—Karenni 3,000 feet (Wardlaw Ramsay); pine forests of the Salween (Davison).
Specimens.—Nattaung 2♂.
Noted.—Not collected at Thandaung, but probably occurs.

742. **Pericrocotus s. solaris.** Yellow-throated Minivet.

Previous records.—None before 1939.
Specimens.—Nattaung 1♂.
Noted.—Not collected at Thandaung, but may occur.

[744. **Pericrocotus r. roseus.** Rosy Minivet.

According to the *F.B.I.* it has been recorded from the Shan States and Tenasserim and is therefore likely to occur in our area, but so far there are no records or specimens.]

[746. **Pericrocotus cinnamomeus vividus.** Burmese Small Minivet.

Wardlaw Ramsay obtained it in Karenni, elevation not stated. We have not seen it and doubt whether it occurs over 3,000 feet.]

754. **Lalage melaschistos melanoptera.** Pale Grey Cuckoo-Shrike.

Previous records.—Karen Hills; Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1♀ juv.; Thandaung 1♀.
Noted.—Common on Nattaung but at Thandaung noted only at the end of the rains. It is curious that the call-note: 4 notes with the last two dropping in pitch, *wee-wee-weyou-weyou*: should differ from this bird's call in Maymyo.

761. **Graucalus macei siamensis.** Siamese Large Cuckoo-Shrike.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not uncommon on Nattaung and also noted at Thandaung.

763. **Artamus fuscus.** Ashy Swallow-Shrike.

Previous records.—None before 1939.
Specimens.—None this year.
Noted.—Not seen at Thandaung but may occur.

769. **Dicrurus macrocercus cathoecus.** Chinese Black Drongo.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Once only, at Thandaung on 22 October when it was probably on passage.

772. **Dicrurus leucophaeus mohouti.** Burmese Grey Drongo.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 2♀.
Noted.—Status uncertain. It seemed to be absent from Thandaung in September but was much in evidence in October; after 1 May it again disappeared, so that it may only winter in the hills.

780. **Chaptia aenea aenea.** Northern Bronzed Drongo.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1♀.
Noted.—Occasionally seen both on Nattaung and at Thandaung.

782. **Chibia h. hottentotta.** Indian Hair-crested Drongo.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—Seen at Thandaung in October and March (when it was common), and on Nattaung in evergreen and pine forest up to 5,000 feet.

786. **Bhringa remifer tectirostris.** Indian Lesser Racket-tailed Drongo.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—Common both on Nattaung and at Thandaung.

[788. **Dissemurus paradiseus rangoonensis.** Burmese Large Racket-tailed Drongo.

Recorded by Salvadori from the Karen Hills (elevation?); we have not seen it and doubt whether it occurs over 3,000 feet. Cook, who recorded it as common and breeding at Thandaung, must have confused it with the preceding species.]

803. **Acrocephalus agricola stevensi.** Plains Paddy-field Warbler.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♀, 1 o; Thandaung 2 ♂.
Noted.—Not uncommon on Nattaung and noted up to 23 April; several birds were observed in the tea estate at Thandaung in March, but they had all left by 24 April. We saw no signs of breeding, and the bird appears to be either a winter visitor or a passage migrant. In the field it resembles *Phylloscopus fuscatus*, and has a similar call-note, but can be distinguished by the fact that it is much less active and more of a skulker; it is also lighter in colour and has a noticeably longer and more ragged tail. It frequents thick undergrowth where there is little or no overhead cover, and though sometimes seen near the bank of a stream it was more often, and more surprisingly, observed on the driest of dry ridges, where it was wont to lie dormant most of the day and come to life only in the early mornings or evenings. It is most difficult to observe, and on one occasion it took a full hour of watching and waiting to get a glimpse of a bird calling in thick undergrowth. The fact that the first specimens were identified by us (incorrectly) as *Tribura* sp. indicates the difficulty of naming these skulking Warblers, even with the bird in the hand.

814. **Orthotomus sutorius patia.** Burmese Tailorbird.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

818. **Orthotomus atrogularis nitidus.** Burmese Black-necked Tailorbird.

Previous records.—None.
Specimens.—None.
Noted.—Not uncommon both on Nattaung and at Thandaung, where breeding pairs were observed in May. It is very tame and I have watched a pair at a range of four feet; the sexes are easy to distinguish in the field and the trilling call-note *kri-kri-kri-*, repeated a varying number of times, is quite distinctive.

827. **Franklinia gracilis hodgsoni.** Franklin's Wren-Warbler.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None this year.
Noted.—Franklinias were twice seen at Thandaung, but the species was not distinguished.

828. **Franklinia r. rufescens.** Beavan's Wren-Warbler.

Previous records.—Karen Hills 2,000 feet (Wardlaw Ramsay).
Specimens.—None.
Noted.—See under preceding species.

839. **Phragmaticola aedon.** Thick-billed Warbler.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Thandaung 1♀.
Noted.—Several birds arrived in Thandaung on 8 May on passage, and birds were seen and heard singing up to 12 May, when I left. The song is mainly low in pitch and lacks power, but though thin is not unpleasant.

[*Note.*—Some of the other migrant Warblers may occur in the hills on passage and should be looked for. A small party that I strongly suspect were *Acrocephalus arundinaceus*, but of which I failed to obtain a specimen, was seen in Thandaung on 8 May. A species of *Tribura* has recently been obtained on Mt. Byingye and is likely to occur in our area.]

851. **Phylloscopus schwarzi.** Radde's Willow Warbler.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—Thandaung 1♂, 1♀, 1 o.
Noted.—It probably winters in the tea estate and was very common there in March; birds on passage were noted in April-May, the last on 9 May, and the first specimen was obtained on 3 November. It resembles *P. fuscatus* in habits and makes a *tschik tschik* note in bushes, but is easily recognised by plumage.

864. **Phylloscopus p. pulcher.** Nepal Orange-barred Willow Warbler.

Previous records.—Karenni, 3,000 feet (Wardlaw Ramsay).
Specimens.—None this year.
Noted.—Scarce and confined to the higher slopes of Nattaung.

871. **Phylloscopus i. inornatus.** Crowned Willow Warbler.

Previous records.—None before 1939?
Specimens.—Nattaung 1♂.
Noted.—Common and probably winters all through these hills.

871. **Phylloscopus proregulus chloronotus.** La Touche's Yunnan Willow Warbler.

Previous records.—Taho (Salvadori); pine forests near papun (Davison).
Specimens.—None.
Noted.—Not seen by us.

863. **Phylloscopus m. maculipennis.** Grey-faced Willow Warbler.

Previous records.—None nearer than Mt. Victoria and North-East Burma.
Specimens.—Nattaung 2♀, 1 o.
Noted.—Found only on Sosiko, 7,000-7,500 feet. It is easily recognised by small size, intense activity, and grey head contrasting with olive-green back and yellow rump. Those observed were working through the undergrowth in evergreen at 3 to 6 feet from the ground. No evidence of breeding was obtained.

[878. **Phylloscopus magnirostris.** Large-billed Willow Warbler.

Davison obtained it at Thaton, and it is not unlikely to occur in the hills on passage though there is no record so far. The dark tip to the lower mandible is probably the best field distinction from the next species.]

880. **Phylloscopus t. trochiloides.** Dull Green Willow Warbler.

Previous records.—None?
Specimens.—Thandaung 2♂ (25-9-39) and (7-5-40), 1♀ (28-4-40).
Noted.—Probably winters in small numbers.

876. **Phylloscopus trochiloides plumbeitarsus.** Middendorff's Willow Warbler.

Previous records.—None.
Specimens.—Thandaung 2♂ (25-9-39).
Noted.—These two specimens were the only birds seen, and must have been on passage.

[879. **Phylloscopus tenellipes.** Pale-legged Willow Warbler.

We did not meet with this species, which Davison obtained at Kyaukhnyat and which probably occurs in the hills on passage.]

884. **Phylloscopus reguloides assamensis.** Baker's Willow Warbler.

Previous records.—None before 1939?
Specimens.—Nattaung 2♂, 2♀.
Noted.—A male was shot off a nest on the top of Sosiko, 7,500 feet, on the edge of temperate forest. The nest was compactly made of moss and was built on the ground under a tuft of grass, and contained 3 young just ready to leave. Another nest, containing 2 young of about the same age, was found on a hillside under a tuft of grass; it was made entirely of moss of a felt-like texture, and had a dome of moss. The note of this bird is difficult to describe: *pit-chew-a-pit-chew-a-pit-chew-a...* the three notes slurred into each other to produce a continuous undulating wave of sound; the alarm-note is *zip-aye... zip-aye*, or *cheep-it...cheep-it.* Not collected at Thandaung but probably resident there also.

886. **Phylloscopus reguloides claudiae.** Pallas's Himalayan Willow Warbler.

Previous records.—None before 1939?
Specimens.—None this year.
Noted.—We were unable to detect any difference in the call-notes of *assamensis*, *claudiae*, and *davisoni*. All three are typical leaf *Phylloscopi*, frequenting the canopy and occasionally the understorey.

885. **Phylloscopus d. davisoni.** Tenasserim White-tailed Willow Warbler.

Previous records.—Thandaung, breeding (Cook).
Specimens.—Nattaung 1♂, 1♀, 1 0; Thandaung 1♀.
Noted.—Common.

[895. **Phylloscopus cantator.** Tickell's Willow Warbler.

Wardlaw Ramsay obtained it in the Karen Hills near Toungoo (elevation?), but we have not met with it east of the Sittang.]

890. **Seicercus burkii tephrocephalus.** Anderson's Flycatcher-Warbler.

Previous records.—Karen Hills (Wardlaw Ramsay); Taho (Salvadori).
Specimens.—Thandaung 1♂.
Noted.—Not uncommon both on Nattaung and at Thandaung. It keeps to dense bamboo thickets and undergrowth, and often associates with *Stachyris chrysaea.* It has a *chip-chip* call-note. It was observed from September to mid-April, but none was seen after 24 April, and it either becomes very secretive in the breeding season or else migrates. It is known to breed in the Chin Hills and North-East Burma and probably breeds in the Shan States; proof that it breeds in our area would be of interest.

896. **Abroscopus s. superciliaris.** Yellow-bellied Flycatcher-Warbler.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 2♂, 1♀; Thandaung 1♂.
Noted.—Common both on Nattaung and at Thandaung up to 4,500 feet in *ponzo,* bamboo and wet thickets.

910. **Homochlamys fortipes** subsp. Strong-footed Bush Warbler.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1♀; according to Dr. Ticehurst this specimen probably represents a new race.
Noted.—The only bird seen was skulking in long grass beside the Mawchi road at 4,500 feet and uttering a call-note like that of *Muscicapa parva* curtailed. In the field it looks a small dark brown bird with a buff supercilium.

913. **Homochlamys p. pallidipes.** Blanford's Bush Warbler.

Previous records.—Karen Hills (Wardlaw Ramsay); Papun (Davison).
Specimens.—None.
Noted.—Not seen by us.

922. **Phyllergates cucullatus coronatus.** Golden-headed Warbler.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None this year.
Noted.—It is common both on Nattaung and at Thandaung, but keeps low down in dense bamboo thickets; one may wait half an hour or more close to a party calling busily without getting even a glimpse of a single bird. The call-note, not very well described in our previous notes, is most distinctive: a four note whistle, the first two notes on the same pitch, the third a trill (or 3 to 4 notes uttered very quickly) and the fourth is either higher or lower in pitch than the first two. This call is repeated in a remarkable number of keys, high and low. Like *Abroscopus* it occasionally climbs 20 or 30 feet up a tall bamboo when feeding.

930. **Suya s. superciliaris.** Anderson's Hill Warbler.

Previous records.—Karen Hills (Wardlaw Ramsay); Thandaung, breeding (Cook).
Specimens.—Nattaung 2 o; Thandaung 1 ♂ (30-4-41).
Noted.—It is a common resident, both in the grassy undergrowth of the pine forests on Nattaung and in the grassy *ponzo* in the tea estate at Thandaung. Its song, *chwee-chwee-chwee*..., 25 times in 10 seconds, is uttered from the top of a bush or tall reed and closely resembles the song of *Orthotomus sutorius patia*, though no doubt differences in volume and pitch would be noticeable if the two were heard calling together. Its call-note resembles the song but is louder, slower, and higher in pitch *pee-up, pee-up, pee-up,*... . Its alarm-note is a continuous reel, uttered by both birds at the nest.

950. **Irena puella sikkimensis.** Fairy Bluebird.

Previous records.—Western slopes of the Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—A bird is usually to be seen on the road up to Thandaung, and on 26 September a party of 4 was seen at 2,500 feet; it is mainly a bird of the foothills and probably seldom exceeds 3,000 feet. It is confined to evergreen and was not seen on Nattaung.

955. **Oriolus chinensis tenuirostris.** Burmese Black-naped Oriole.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Thandaung 1 ♂ immature.
Noted.—Not uncommon. The race *diffusus* has been recorded from Thaton (Davison) and probably occurs in our area.

958. **Oriolus x. xanthornus.** Indian Black-headed Oriole.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—None seen by us; evidently scarce above 3,000 feet.

961. **Oriolus t. trailii.** Maroon Oriole.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♀.
Noted.—It is not uncommon on Nattaung and frequents both evergreen and the more open parts along the Mawchi road, where the specimen was obtained. A bird was observed carrying food in its bill on 21 April. The notes are similar to those of *chinensis*, but rarely heard. Seen occasionally at Thandaung.

[964. **Gracula intermedia religiosa.** Indian Grackle.

There seem to be no records from the area; if it occurs it is probably confined to the foothills.]

970. **Saroglossa s. spiloptera.** Spotted-winged Stare.

Previous records.—'Tolerably abundant on the thickly wooded slopes of the Karen Hills' (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us; as all the Burma records are between December and February we may have been too late for it.

Mynas. We saw none. Wardlaw Ramsay obtained in Karenni, Jerdon's Myna (*G. burmanica*) and the Siamese Jungle Myna (*Aethiopsar griseus grandis*), the latter at 3,000 feet. Mawchi, which we did not visit, is a likely place for them.

1024. **Uroloncha striata acuticauda.** Hodgson's Munia.

Previous records.—Karen Hills (Wardlaw Ramsay and Salvadori).
Specimens.—Nattaung 1 ♂.
Noted.—A few parties were seen in the growth beside streams running through *taungyas*, and once at 5,500 feet in pine forest. In Thandaung they are common in large parties all round the tea estate, and are probably the birds recorded by Cook as *punctulata*, which we did not see. A pair was observed building a nest on 12 May.

[1037. **Amandava a. flavidiventris.** Burmese Red Munia.

Obtained by Wardlaw Ramsay in Karenni, elevation not stated. It is unlikely to occur above 3,000 feet.]

1069. **Carpodacus erythrinus roseatus.** Hodgson's Rose Finch.

Previous records.—Karen Hills (Wardlaw Ramsay and Salvadori).
Specimens.—Nattaung 1 ♀.
Noted.—Cook obtained one from the lower hills below Thandaung, but we have not seen it there.

1090. **Hypacanthis spinoides ambiguus.** Yunnan Green Finch.

Previous records.—None.
Specimens.—Nattaung 1 ♀, 1 o.
Noted.—Not seen at Thandaung and probably absent. It is common in the pine forests of Nattaung, in which it keeps mainly to the tree tops and frequently perches on the topmost point of small pines. The broad yellow band from base to tip of wing, dividing it into three roughly equal parts, is diagnostic in flight and the blackish head when perched. The call, freely uttered, is a thin metallic tinkle and quite distinctive.

1107. **Passer rutilans** subsp. Cinnamon Sparrow.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 2 ♂, too worn to determine subspecifically.
Noted.—Not seen at Thandaung. The specimens were obtained from isolated trees in *taungyas*, and one of them was singing something like *chwe-cha-cha* repeated over and over, a thin but pleasant song. One other male was seen but no females, which were probably sitting.

1108. **Passer flaveolus.** Pegu House Sparrow.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us; may not occur above 3,000 feet.

(*Note.*—We saw no 'house Sparrows' (*P. domesticus* & *P. montanus*) but they may occur at Mawchi).

1120. **Emberiza f. fucata.** Grey-headed Bunting.

Previous records.—Yado (Salvadori).
Specimens.—None.
Noted.—Not seen by us.

1122. **Emberiza pusilla.** Little Bunting.

Previous records.—Karenni (Wardlaw Ramsay); Yado (Salvadori).
Specimens.—None.
Noted.—Not seen by us. Possibly it migrates early.

1131. **Emberiza aureola.** Yellow-breasted Bunting.

Previous records.—Taho (Salvadori).
Specimens.—Thandaung 1 ♂, 1 o.
Noted.—The specimens were obtained at Thandaung in the tea estate on 28 April and 9 May, the male being one of a pair and the other a solitary bird. It does not winter at Thandaung, and these birds were passage migrants.

1135. **Emberiza rutila.** Chestnut Bunting.

Previous records.—Described by Wardlaw Ramsay as the common Bunting of the higher Karen Hills, and recorded by Salvadori from Yado. Cook obtained one at Thandaung in April.
Specimens.—None.
Noted.—The only bird seen was a male on 20 March at 4,200 feet in Thandaung, in undergrowth at the edge of a small clearing. It seems to be more of a forest bird than other Buntings, and possibly migrates early.

1139. **Melophus lathami subcristata.** Crested Bunting.

Previous records.—Described by Wardlaw Ramsay as 'by far the commonest Bunting in the Karennee country, where the rocky scrub-covered hill-sides seem to suit it. It is particularly fond of the neighbourhood of tiny streams covered with bushes in open country. Their note, which is uttered on the wing, is a rather pleasing whistle quite unlike that of any other Bunting.' Apparently he did not find it over 3,000 feet. Recorded from Yado by Salvadori.
Specimens.—None.
Noted.—It is curious that we did not meet with this bird at all.

1143. **Martula urbica whiteleyi.** Siberian House Martin.

Previous records.—None.
Specimens.—Nattaung 1 ♀.
Noted.—As Stanford has commented (*Ibis,* Oct. 1938 p. 622) on the lack of authentic records of House Martins, the following notes may be of interest :—

A party of House Martins, either *M. u. whiteleyi* or *M. dasypus cashmeriensis*, was observed hawking insects over the summit of the Kambilu Taung, 2,634 feet; this hill is in the Tharrawaddy district (Zigon forest division) a few hundred yards off the main Pegu Yoma ridge (Irrawaddy-Sittang divide), and is the second highest hill in the Pegu Yomas. The House Martins were in company with a large flock of White-rumped Swifts, and appeared little more than half their size. This was on 13 December 1935, but when I climbed the same hill on 7 December 1937 there were no House Martins.

A party of *M. d. cashmeriensis* (1 ♂ obtained and sent home to Dr. Ticehurst but unfortunately lost in transit) was observed hawking insects over the summit of a 5,208 foot peak in the Arakan Yomas close to the main Yoma ridge (Irrawaddy-Bay of Bengal divide); the summit is on the boundary between the Thayetmyo and Minbu districts, and is one of the few peaks in these hills with a bare grassy top. The birds were seen on 4 and 5 December 1938.

A large flock of House Martins was seen on Nattaung last year, but no specimen was obtained (vide our previous paper).

On Nattaung this year large flocks, totalling hundreds of birds were seen almost daily throughout our visit, and the specimen obtained was *M. u. whiteleyi*; they appeared at about 8 a.m. and hawked insects through the heat of the day over the pine forest, especially where the trees had been felled and the ridges and knolls were bare, until the early afternoon, when they disappeared.

Finally a large flock appeared in Thandaung on 29 April, but was not seen again.

It seems therefore that the Siberian House Martin is a regular winter visitor in comparatively large numbers, arriving early in November (when Livesey saw them at Taunggyi) and leaving in early May, and that it has been overlooked in the past only because it spends the winter over inaccessible mountain ranges, whence it is occasionally driven by bad weather. It would be interesting to learn where they roost at night.

[1150a. **Riparia concolor sintaungensis.** Dusky Crag Martin.

This was obtained by Mr. H. C. Smith on Mt. Byingye in November 1938, and Davison observed Crag Martins in Tenasserim many years ago. We did not visit any rocky hill-tops, but observed some in the distance where these birds might occur.]

1153. **Hirundo rustica gutturalis.** Eastern Swallow.

Previous records.—None?
Specimens.—None.
Noted.—A flock appeared in Thandaung on passage on 30 April, a few of which stayed till 2 May.

[1154. **Hirundo rustica tytleri.** Tytler's Swallow.

Wardlaw Ramsay found them common in the plains of Karenni, and they probably pass through the hills on migration, but have not been recorded thence up to date.]

1160. **Hirundo daurica striolata.** Chinese Striated Swallow.

Previous records.—Karen Hills (Wardlaw Ramsay, recorded as *H. arctivitta*).
Specimens.—None.
Noted.—On 8 April 1938 we saw a Striated Swallow fly out of small cave beside the Mawchi road, and when we investigated on 18 April we found the beginnings of a mud nest, which the bird had evidently abandoned. It seems likely that *striolata* is resident in these hills.

1161. **Hirundo daurica japonica.** Hodgson's Striated Swallow.

Previous records.—None.
Specimens.—Thandaung 1♂.
Noted.—A large flock appeared on passage on 30 April and was not seen again; the birds mixed freely with the Eastern Swallows that appeared on the same date. Both species settle freely on telegraph wires. Another flock was seen on 22 March at Thandaung.

1166–73. **Motacilla alba** subsp. White Wagtail.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—A bird was seen in the tea estate at Thandaung on 8 October 1941.

1174. **Motacilla cinerea melanope.** Eastern Grey Wagtail.

Previous records.—Karen Hills.
Specimens.—Nattaung 1♂.
Noted.—It had arrived in Thandaung on 30 August 1941 and was common thereafter, especially along the roads. Last seen on 29 April.

1176. **Motacilla flava** subsp. Grey-headed Wagtail.

Previous records.—Karenni at 3,000 feet (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

1183. **Dendronanthus indicus.** Forest Wagtail.

Previous records.—None.
Specimens.—Thandaung 1♂ (24 September 1938).
Noted.—Two birds were seen along the Leiktho mule path on 24 September 1939 and one bird on the Kemapyu stream at 3,000 feet on 10 April. Status uncertain.

1186. Anthus h. hodgsoni. Indian Tree Pipit.

Previous records.—Karen Hills (Cook, Salvadori).
Specimens.—Thandaung 1 ♀, 1 o.
Noted.—It was not seen round Thandaung on 23-25 September, but was first noted on 8 October; it was last seen on 9 May when a specimen was obtained. On Nattaung it swarms in the grassy undergrowth of the dry pine ridges, where it may be found in the heat of the day when most birds have retreated to the valley bottoms. The return migration must take place early in May.

1193-4. Anthus richardi subsp. Richard's Pipit.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Several birds were seen on passage in the tea estate at Thandaung, 7-9 May.

[*Anthus roseatus?* I saw a very dark Pipit along the Leiktho road on 23 September and failed to collect it. Unlike *A. h. hodgsoni* it did not fly up into a tree when disturbed but settled further along the path.]

1247. Zosterops palpebrosa subsp. White-eye.

Previous records.—Karen Hills (Wardlaw Ramsay); Karenni (Salvadori), recorded in *F.B.I.* as *Z. a. mesoxantha.*
Specimens.—Nattaung 1 ♀; Thandaung 5 ♂.
Noted.—Common in parties, especially at Thandaung, where the parties were splitting up into pairs in May.

[**1252. Zosterops simplex.** Pegu White-eye.

Cook recorded this as common at Thandaung and also listed it from Kalaw, but apparently did not collect any; we did not meet with it and further evidence of its occurrence in the area is required.]

1253. Zosterops siamensis. Siamese White-eye.

Previous records.—Karen Hills and Karenni.
Specimens.—Nattaung 3 ♂.
Noted.—In contrast to other White-eyes all those seen were solitary, frequenting open scrub along the Mawchi road and bushes near streams running through *taungyas,* 4,000-5,000 feet. It did not appear to be breeding. Its note differs from that of *palpebrosa* and is stronger.

— Zosterops erythropleura. Chinese White-eye.

Previous records.—None before 1939.
Specimens.—Thandaung 1 ♀.
Noted.—A winter visitor. It was not seen in Thandaung in September and October: the specimen was obtained out of a party seen on 2 November: a number of large parties were seen on 20-24 March, when the maroon on the flanks appeared much deeper than in November; and none was seen after I returned on 24 April, though I looked for them daily. Several parties were seen on Nattaung, but not after mid-April. In habits and voice it is similar to *palpebrosa.*

1260-2. Aethopyga siparaja subsp. Yellow-backed Sunbird.

Previous records.—None.
Specimens.—None.
Noted.—Except for a male seen in Thandaung on 1 November, uttering a very high pitched trilly song, we have not seen this species, which is more a bird of the foothills.

1271. Aethopyga gouldiae dabryi. Dabry's Sunbird.
Previous records.— Karen Hills; Karenni 4,000 feet (Wardlaw Ramsay).
Specimens.—Nattaung 2 ♀; Thandaung 1 ♂.

Noted.—Rather scarce; in Thandaung it was seen only in November and March, and on Nattaung two or three times. It seems to prefer fairly open scrub and bushes bordering streams, and has twice been seen just below the top of Thandaung-gyi.

1273. **Aethopyga s. sanguinipectus.** Walden's Yellow-backed Sunbird.

Previous records.—Karen Hills; Karenni (type locality, Wardlaw Ramsay).
Specimens.—Nattaung 2♂; Thandaung 1♂, 1♀.
Noted.—Fairly common up to 5,000 feet. It keeps mainly to evergreen and is very partial to streams running through this type of forest, where I have often seen them feeding along the bushes on the banks in the middle of the day. It also visits the more open country.

1276a. **Aethopyga nipalensis karenensis**. Nattaung Sunbird.

Previous records.—None before 1939.
Specimens.—None this year.
Noted.—This appears to be confined to the Pine-Rhododendron association and temperate forest on the higher slopes of Nattaung; it is common there, but none was seen below 7,000 feet.

1279. **Cinnyris asiatica intermedia.** Burmese Purple Sunbird.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us. May not occur above 3,000 feet.

1293. **Arachnothera m. magna.** Indian Streaked Spiderhunter.

1294. **Arachnothera m. aurata.** Pegu Streaked Spiderhunter.

Previous records.—Karen Hills (Wardlaw Ramsay); Thandaung (Cook).
Specimens.—Thandaung 1♀ (nearest *aurata*); the specimen obtained last year on Nattaung was *magna*.
Noted.—The two races evidently intergrade in the Karen Hills. The bird is not uncommon and there seemed to be an influx at the end of April into Thandaung.

1296. **Arachnothera l. longirostra**. Little Spiderhunter.

Previous records.—Thandaung (Cook).
Specimens.—None.
Noted.—Scarce. Only observed in the tea estate at Thandaung in October, April and May. The flight is direct and strong, and a bleating note is uttered on the wing.

1298-9. **Dicaeum cruentatum** subsp. Scarlet-backed Flowerpecker.

Previous records.—None.
Specimens.—None.
Noted.—Although it is common in Toungoo town we have seen only one in the hills, on 2 November at Thandaung.

1300. **Dicaeum trigonostigma rubropygium.** Tenasserim Orange-bellied Flowerpecker.

Previous records.—Karen Hills 3,000 feet (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

1302. **Dicaeum chrysorrheum chrysochlore.** Burmese Yellow-vented Flowerpecker.

Previous records.—Karen Hills (common at 3,000 feet, F.B.I.).
Specimens.—None.
Noted.—Except for a pair in the tea estate on 10 May we saw none, and it must be either local or a bird of the foothills.

1303. **Dicaeum i. ignipectus.** Fire-breasted Flowerpecker.

Previous records.—Karenni.
Specimens.—Thandaung 1♂, 1♀.
Noted.—This is the typical Flowerpecker of the area; it keeps to the tree-tops and would escape observation but for its clicking note on the wing. I have seen a male utter a long continuous series of clicks from a perch, while swaying his body from side to side.

1306. **Dicaeum concolor olivaceum.** Plain-coloured Flowerpecker.

Previous records.—Karen Hills, type locality (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

[1312. **Piprisoma m. modestum.**

It has been recorded from the Southern Shan States, Tenasserim, and the Pegu Yomas in the Toungoo district, though not as yet from our area, in which it seems likely to occur.].

1316. **Anthocincla phayrei.** Phayre's Pitta.

Previous records.—This bird was first obtained in the Toungoo district, 'probably in the higher hills to the east of the Sittang river'. The *F.B.I.* states that Bingham found a nest at about 5,000 feet in the Karen Hills, whereas he actually found it near a Karen village in the Dawnas (Meple valley, Northern Tenasserim).
Specimens.—None.
Noted.—Not seen by us.

1318. **Pitta oatesi.** Fulvous Pitta.

Previous records.—Karenni 2,500-4,000 feet (Wardlaw Ramsay); Taho (Salvadori).
Specimens.—Nattaung 1♀.
Noted.—This, the only bird seen, was in the bed of a stream running through evergreen at 3,500 feet on Nattaung, and was obtained at about 2 p.m.

1320 **Pitta c. cyanea.** Blue Pitta.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—Thandaung 1 o.
Noted.—A bird was given alive and apparently uninjured by a Karen to the durwan of the Circuit House, but it died a few days afterwards and the corpse was presented to me on 22 October; seen once or twice near Pathichaung at about 500 feet.

[1321. **Pitta moluccensis** Lesser Blue-winged Pitta.

The *F.B.I.* gives this from the Karen Hills, based on Hume's loose statement that it breeds from Arakan to Karenni; all specimens and records indicate that it is a low elevation species.]

[1325. **Pitta c. cucullata.** Green-breasted Pitta.

A Pitta seen on the Leiktho mule path, the upper-parts of which appeared very dark as it hopped off into the bamboo thickets below, must have belonged to this species; it was certainly not *P. moluccensis, P. c. cyanea*, or *P. oatesi.*]

[1328. **Eurylaimus javanicus** Horsfield's Broadbill.

Lloyd is said to have obtained it in the Toungoo hills, and the *F.B.I.* gives it from Karenni, but proof of its occurrence is desirable.]

1330. **Corydon sumatranus.** Dusky Broadbill.

Previous records.—Karen Hills (Wardlaw Ramsay)
Specimens.—None.

Noted.—Except for a bird seen in a tree-top beside the Leiktho mule path at 3,500 feet we have not met with this bird. The broad reddish bill and red orbital skin contrasting with the black head are diagnostic.

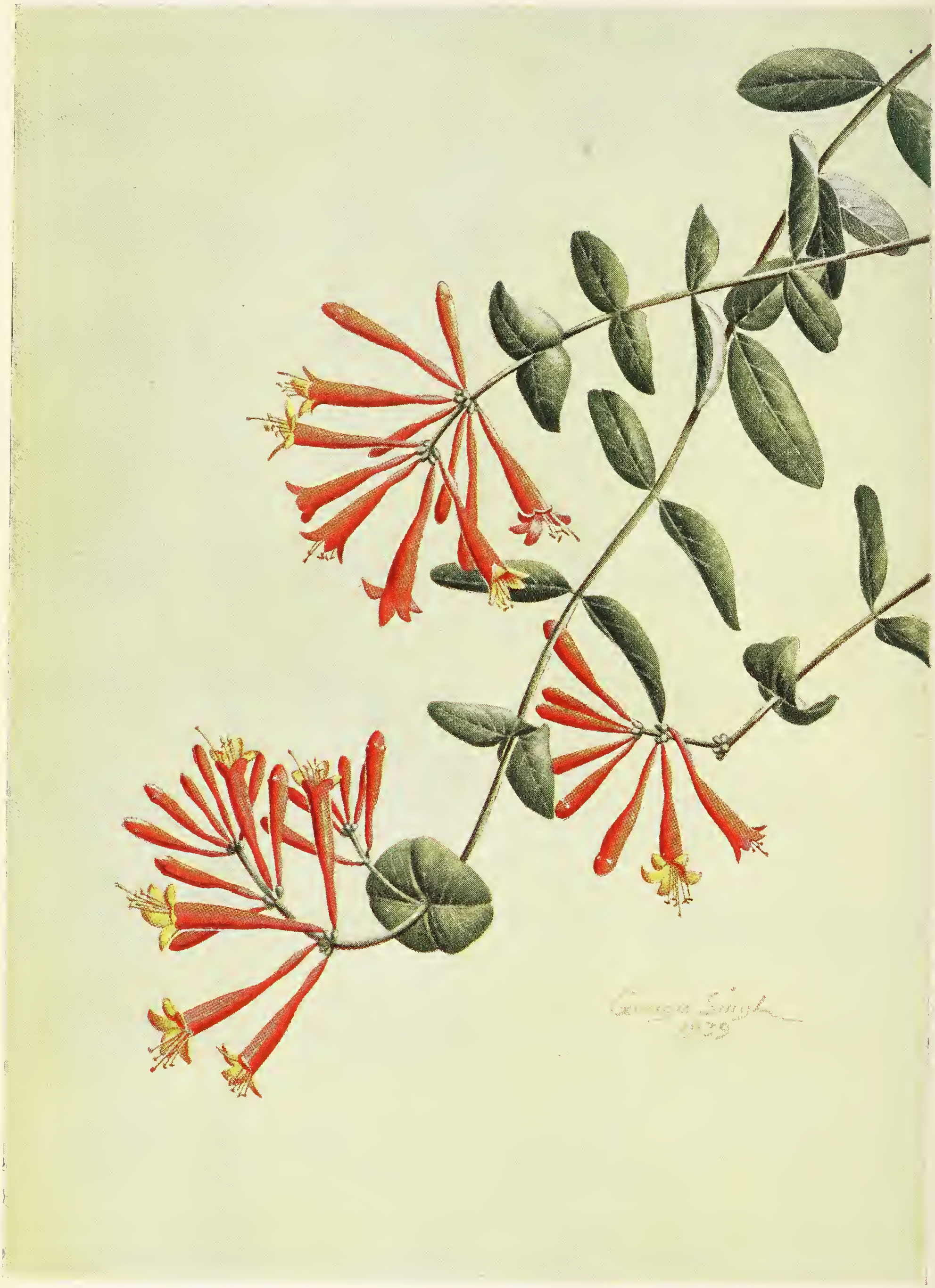
1333. **Serilophus l. lunatus.** Gould's Broadbill.

Previous records.—Karenni 3,000-4,000 (Wardlaw Ramsay). Karen Hills, Taho (Salvadori).
Specimens.—None.
Noted.—Not seen by us.

1335. **Psarisomus dalhousiae.** Long-tailed Broadbill.

Previous records.—Karen Hills (Wardlaw Ramsay); Yado (Salvadori).
Specimens.—Nattaung 1♂, 1♀.
Noted.—Fairly common, both on Nattaung and at Thandaung; it keeps mainly to evergreen, but we have noted it in high regrowth. The call is a loud piercing whistle of 5 to 8 notes with little if any change in pitch; it occasionally utters a single *weet* note. A pair was observed building a nest on 15 April. The nest was quite typical, suspended from the tip of a branch overhanging a stream where the pine forest merged into evergreen.

(*To be continued*)



The Trumpet Honey-suckle
LONICERA SEMPERVIRENS Linn.
(Nat size.)

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

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AND

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PART XIV

(*Continued from Vol.* xliii, *No.* 4 (1943), *p.* 552).

(*With* 1 *coloured and* 2 *black and white plates, and* 3 *text-figures*).

Lonicera Linn.

The Honeysuckle or Woodbine.

(A genus named in honour of Adam Lonitzer, Professor of Medicine in Mainz, 1528-86).

Lonicera L. is a genus of the family *Coprifoliaceae* and comprises about 160 species which are distributed in the sub-tropical and temperate regions of the northern hemisphere, from the arctic circle southwards to the Malayan Archipelago, Southern Asia, North Africa, Madeira and Mexico.

Characters of the genus.—Upright to twining, rarely creeping shrubs. Stems glabrous or hairy, often glandular, with fistulose (hollow) or solid branches. The leaves are opposite, petioled or sessile and often with opposite pairs connate at the base. Stipules usually opposite, but occasionally interpetiolar stipules are present. Flowers white or yellow, purple or scarlet, usually arranged in simple cymes which are 2-flowered by the suppression of the middle flower, or three-flowered, and sessile or whorled and collected in terminal spikes or panicles. Individual flowers subtended by bracts and bracteoles. Calyx tube short, adnate to the ovary, ovoid or subglobose with a short, 5-toothed limb. The corolla is tubular to funnel-form or sometimes campanulate with a regular five-lobed limb or 2-lipped, in which case the upper lip is 4-lobed; lobes long or short, imbricate in the bud. Stamens five, inserted in the tube, usually near the mouth, usually exserted. Ovary inferior, 2- to 3-celled; each cell with 3-8 ovules pendulous from the inner angles. Style elongated, with a capitate stigma, usually exserted from the tube. Fruit a red or yellow berry, few-seeded. The receptacle at the base of the corolla tube secretes a nectar. Cross-fertilisation is accomplished by insects which come to take the nectar.

Before we show how this cross-fertilisation takes place we shall describe the mechanism of a typical specimen of the genus, *Lonicera periclymenum* L., a European species.

Just before the erect flower buds open the stigma is receptive and the anthers have already dehisced. The pollen is sticky and as the stigma stands some distance above the anthers, self fertilisation is avoided (A.). When the bud opens the flower sinks through an angle of 90° so that it comes to rest in a horizontal position. The positions of the stamens and style are shown in Fig. B. The style is well out of the way below the stamens whose dehisced anthers are turned upwards. Any insect visitor which now comes to get nectar from the flower is bound to touch the dehisced stamens and carry away pollen on its under surface. After pollen has been removed the filaments wither and sink down. The style at the same time curves upwards and comes to occupy the position indicated in C. It is obvious that in this state of the flower it is the stigma and not the stamens which will touch the undersurface of an insect-visitor. In stage B the flowers are large and brightly coloured; in stage C they have become smaller and duller.

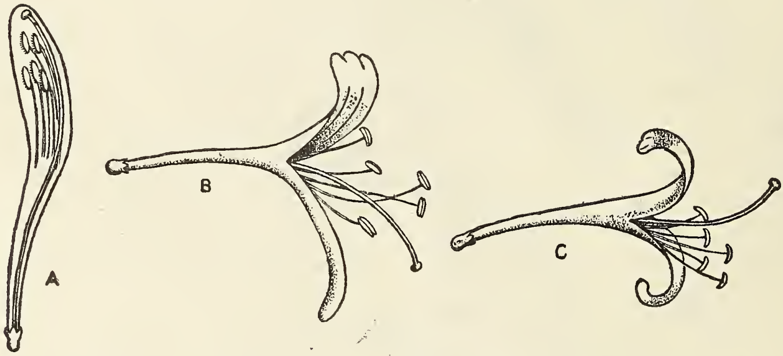

Fig. 1.—Pollination in *Lonicera periclymenum* Linn. after Kurth ×$\frac{3}{4}$.

The process of cross fertilisation is as follows:—On any plant of *L. periclymenum* there will be found flowers in all stages of development from the bud to the fading fertilised bloom. When the bud opens an attractive scent is emitted and the flower itself is fresh and brightly coloured. Hence insects (hawk-moths) visit these flowers, which are in stage A, first. From the relative positions of stamens and style it is certain that the visitor will carry away quantities of pollen. In stage B, the flower has faded and the scent is not so strong, therefore these flowers are visited later, and as may be seen from fig. C. it is the stigma this time which must touch the insect. In this way cross-fertilisation is ensured, The Loniceras are deservedly popular on account of the fragrant pretty flowers and handsome foliage.

KEY TO THE SPECIES.

Leaves connate ... *L. sempervirens.*
Leaves distinct.
Bracts subulate; ovary hairy; leaves and flowers larger. ... *L. confusa.*
Bracts ovate, leafy; ovary glabrous; leaves and flowers smaller. ... *L. japonica.*

Lonicera sempervirens Linn.

The Trumpet Honeysuckle.

(*sempervirens* means evergreen in Latin).

Description.—An extensively climbing, glabrous, woody twiner. Leaves oblong or ovate, rounded at the tips, wedge-shaped or rounded below, opposite, exstipulate, glossy, green on the upper surface, covered with a white bloom below. 2-3 in. long. The upper one or two pairs of leaves are connate by their bases.

Inflorescence a terminal, interrupted spike, the individual flowers being whorled in groups of 4-6, supported by bracts and bracteoles. Calyx adnate to the ovary ending above in five, short, blunt teeth. Corolla tube, 1-2 in. long, seated on top of the ovary slightly ventricose, glabrous outside, sparsely pubescent with white hairs within, scarlet, orange or sometimes yellow on the outer surface, yellow within, five-lobed; lobes reflexed. On the inner surface near the base is an oval-shaped area which is slightly thicker than the rest of the corolla and is covered with stalk-like glands.

Stamens five inserted on the tube below the mouth, alternate with the lobes. Ovary inferior, 2-3 celled. Fruit a red berry. The flowers of this species are not fragrant.

Flowers.—February-March. Does not fruit in this country.

Distribution.—Indigenous to Southern United States. Cultivated in gardens in the plains.

Gardening.—A beautiful twiner when in full bloom with its scarlet, though scentless flowers. It is best adapted for a trellis or pergola. It is a common twiner in English gardens and is readily propagated by layers.

Lonicera confusa DC.

(*confusa* means confused or uncertain in Latin, and refers to the fact that this plant has often been mistaken for a closely allied species, *L. japonica* Thunb.).

Description.—An extensively climbing, hairy species. Stems cylindrical, fistulose, covered with short, dense, brownish hairs. Leaves opposite, ovate-lanceolate in shape rounded at the base, petioled, 2-3 in. long, rather rough, glabrous or sparsely hairy on the upper surface, ciliate on the margins, softly and shortly hairy on the prominent nerves and reticulation of the under surface.

Flowers in axillary, pedunculate pairs, or collected into terminal panicles or spikes of whorled pairs. Pairs of flowers supported by subulate, hairy bracteoles. Calyx adnate to the ovary, very hairy, ending in five subulate hairy teeth. Corolla 1 in. long, two-lipped, softly and shortly hairy within and without, white fading to yellow; tube as long as the lips; upper lip 4-, the lower 1-lobed. Stamens five, alternate with the lobes of the corolla, long exserted. Style long, filiform. Ovary inferior.

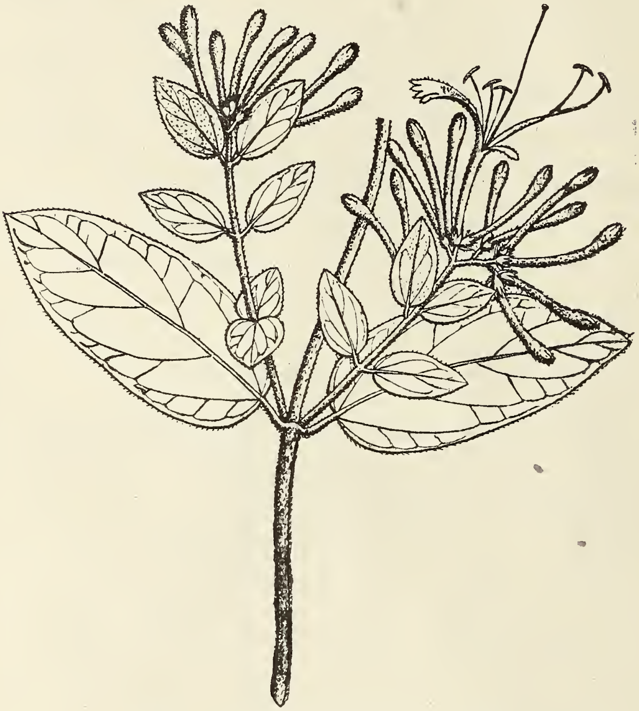

Fig. 2.—*Lonicera confusa* Dc. ×$\frac{3}{4}$.

Distribution.—Found wild in China, Java and Borneo. Cultivated in the plains and hills.

Flowers.—March-April. Does not fruit in this country.

Gardening.—An evergreen twining shrub similar to *L. japonica.* The flowers, at first white, afterwards fading to yellow, are produced in March and are quite effective. It is suitable for growing over an arch or trellis. Propagation is by cuttings or layers during the rains.

Lonicera japonica Thunb.

Japanese Honeysuckle.

(The specific epithet indicates the origin of Thunberg's specimen).

Description.—A widely climbing twiner. Stems glandular-hairy, fistulose, cylindrical. Leaves opposite, petioled; ovate to oblong-ovate, $1\frac{3}{4}$-$2\frac{3}{4}$ in. long, rounded at the base, acute or obtuse at the tip, glabrous or sparsely hairy on the upper surface, glabrous or

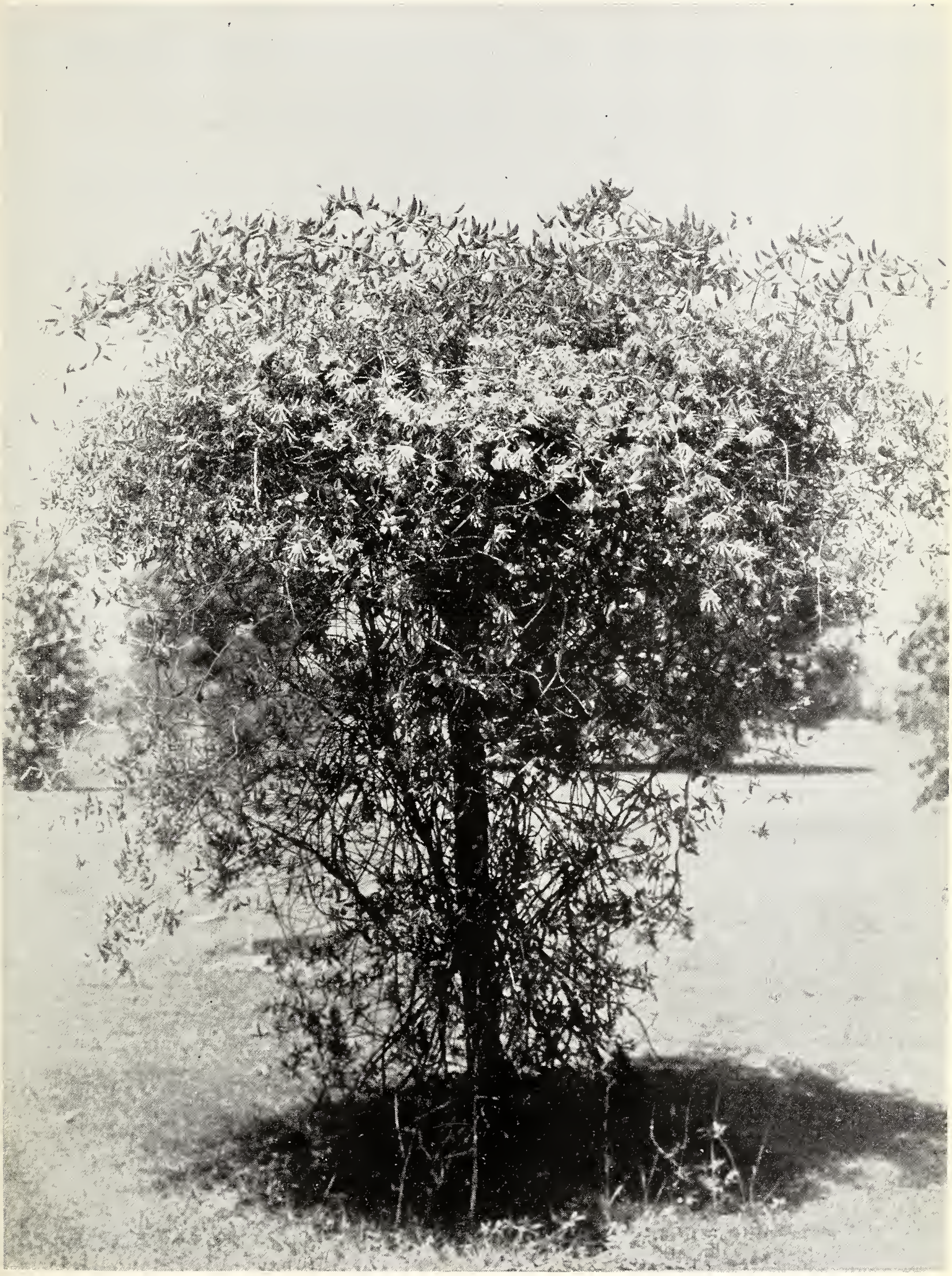

Photo by *M. N. Bakshi*

Lonicera sempervirens Linn.
New Forest, Dehra Dun.

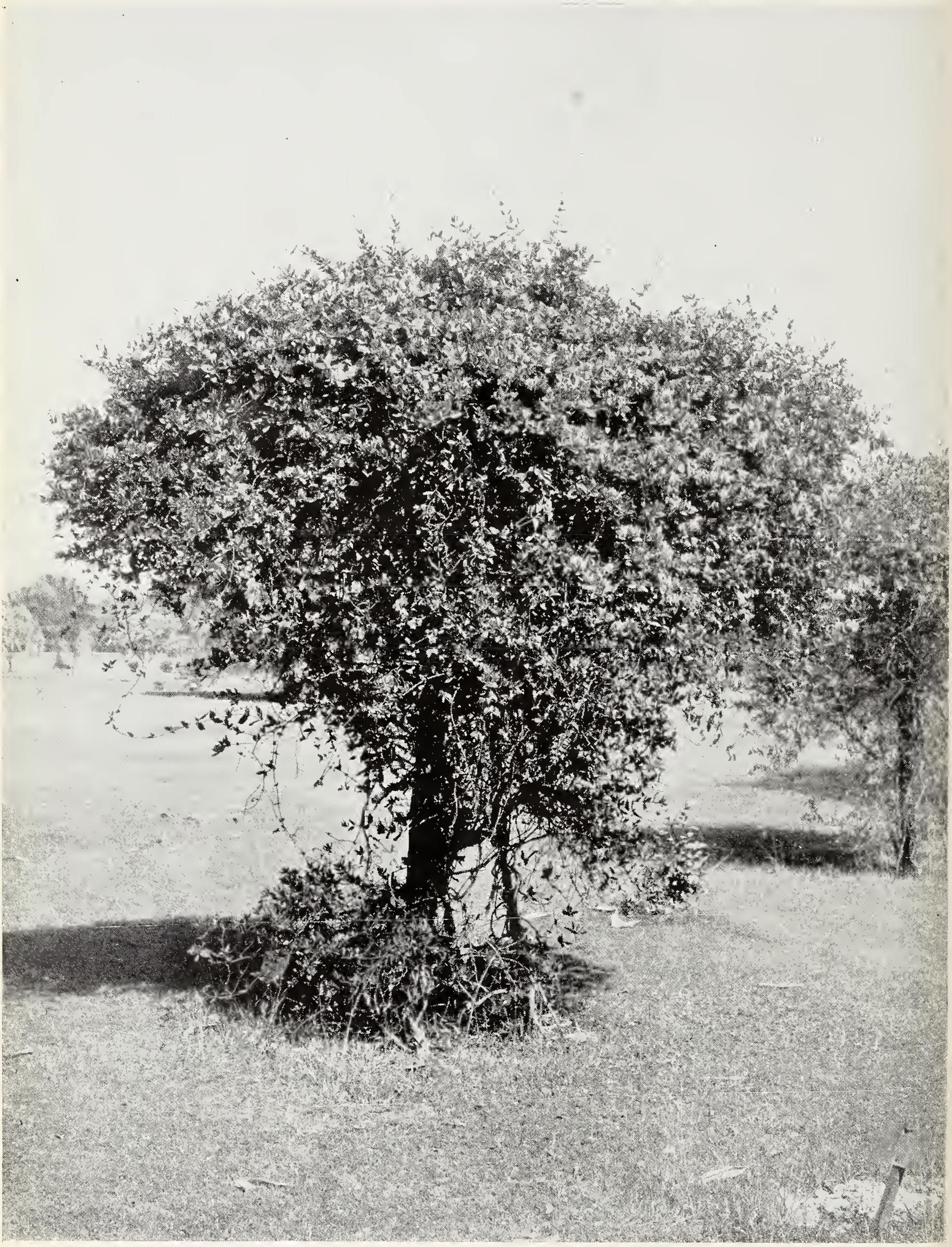

Photo by *M. N. Bakshi*

Lonicera japonica Thunb.
New Forest, Dehra Dun.

softly hairy on the under surface, ciliate on the margins; petiole 1/4 in. long, covered with soft yellow hairs.

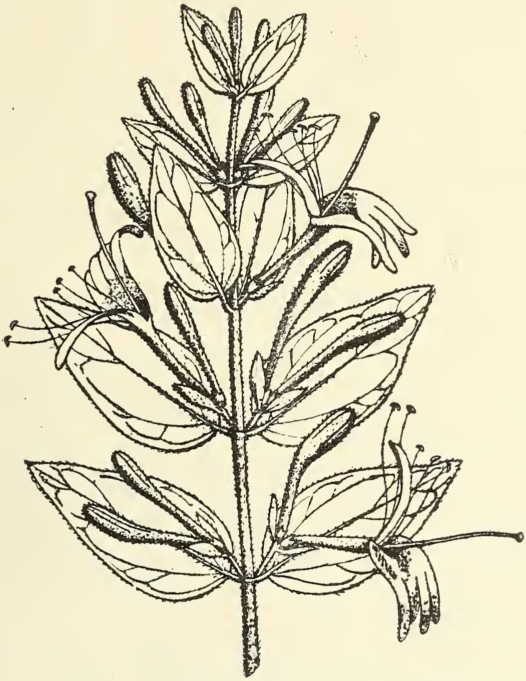

Fig. 3.—*Lonicera japonica* Thunb. ×$\frac{3}{4}$.

Inflorescence similar to that of *L. confusa*. The bracts are, however, foliaceous, instead of subulate, in shape. The corolla is somewhat larger and is hairy and glandular without. The calyx is glabrous.

Flowers.—Cold season. Does not set seed in this country.

Distribution.—Indigenous to China, Japan and Formosa, now commonly grown in gardens in the plains and hill stations.

Gardening.—An evergreen twiner with white red or purple tinged flowers which are very fragrant. It is suitable for trellis work and grows readily from cuttings and layers. The form commonly cultivated in gardens is var. *chinensis*.

THE EARLY STAGES OF INDIAN *LEPIDOPTERA*.

BY

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PART XI

(*Continued from Vol.* xliii, *No.* 3 (1942), p. 415).

RHOPALOCERA

PAPILIONIDAE

Chilasa clytia L., *clytia*

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 393. 1938.
Talbot, *Fauna Brit. Ind.*, Butterflies (2nd edit.), i, 115, pl. 1, figs. 5, 6. 1939.

I have bred this species yearly since 1931, and all larvae have been of the black and cream form first described. This year (1942) all larvae found have had the normally black areas an olivaceous grey dotted with black, not unlike Talbot's figure referred to above, but with the spots larger and fewer. I am unable to account for this sudden change of form.

Talbot, quoting Bell, gives the following description:—'Velvety black or dark green, with a dorso-lateral row of carmine circular spots. A creamy dorsal band on segments 3 to 7, narrowing at both ends and flanked by a broad, lateral, similarly coloured band; also a broad creamy band on segments 11 to 14 externally. Two lateral rows of sharp spines on segments 1 to 4, and a single row on the other segments. Osmeterium a light watery indigo-blue. Length 55 mm.' This description is incorrect in several details—the spines are subdorsal not lateral, the cream bands are wrongly placed, and there are three rows of carmine spots instead of one.

My original description contains an error. It is the lower lateral series of spots that is complete from the 4th to 11th somite, the upper series has spots on the 3rd, 4th, 5th, 7th, 8th and 9th somites only.

Papilio polytes L., *romulus* Cr.

Moore, *Lep. Ceyl.*, i, 150. 1880-81.
Davidson & Aitken, *Journ. Bomb. Nat. Hist. Soc.*, v, 366. 1890.
Bingham, *Fauna Brit. Ind.*, Butterflies, ii, 62. 1907.
Jordan, *Seitz Indo-Austr. Rhop.*, ix, 61. 1909.
Talbot, *Fauna Brit. Ind.*, Butterflies (2nd edit.), i, 177, pl. 1, figs. 18a, 18b, 19. 1939.

Immature larva—Head brown. Body dark olive brown, in some examples almost chocolate, with a diffused white lateral stripe on the thoracic somites, a white V-shaped mark, starting laterally on the 5th somite with the arms joining dorsally on the 8th, and a broad white lateral band on the 10th and 11th somites with a transverse bar across the dorsum of the 12th. A white sublateral line from the 6th somite backwards. 1st somite with a black-tipped, yellowish subdorsal spine. 2nd and 3rd somites with a transverse series of six very short blunt tubercles, barely visible without a lens. 5th somite with a similar lateral tubercle and a dorsal series of four, the centre two in front of the others. 6th to 10th somites each with a similarly placed dorsal series of four. 11th somite with a dorsal pair of slightly larger, pointed, white tubercles. 12th somite with a dorsal pair of still larger tubercles. 4th somite rather swollen. Osmeterium dark purple. Legs brownish. Prolegs greyish white.

Full grown larva similar to that of *Papilio demoleus* L. (1939, mihi, *Journ. Bomb. Nat. Hist. Soc.*, xli, 311) except that the osmeterium is more scarlet than orange; the ocellus on the 3rd somite consists of a black spot surmounted by two whitish dots and surrounded by a yellowish green ring; the line joining the two ocelli is composed of black-ringed yellowish spots; instead of the fawn transverse stripe on the 4th somite there is a very sinuous white line edged behind by an olive green stripe; the subdorsal spines on the 11th somite very much smaller and whitish.

Pupa suspended by a girdle and tail pad of greyish silk. Head bifid, the horns rather longer than in *P. demoleus*, thorax keeled, the keel forming a short forward-pointing horn, the wing cases protruding, abdomen angled at base so that the thorax is bent backwards, three pairs of small subdorsal spines on the abdomen, the hindmost pair smallest. Colour variable, usually green or mottled brown and grey. The green form with a fawn speck at the base of the wing cases, a bluish-white diffused stripe along their upper edge, which continues as a latero-ventral stripe along the abdomen. The anterior portion of the abdomen with a large subdorsal yellow-green triangular mark, with a small red-brown speck at the anterior angle. The brown and grey forms usually with a dark triangular mark on the wing cases. One specimen formed on white paper had a chalky white dorsal stripe on the apical somites of the abdomen.

Food-plant—*Citrus* spp. and *Aegle marmelos* Correa.

Described from a larva found in Calcutta, pupated 22-viii-42, and a male emerged 1-ix-42.

Moore's description is as follows :—'Larva smooth, glossy-green much attenuated posteriorly, anterior segments swollen and scutellated, fourth and fifth segments with dorsal transverse cream-coloured fleshy crest, that on the fourth ending on each side in an eye-like spot; a brown-streaked cream-coloured oblique band ascending from the base of seventh segment, and is nearly united with that from the opposite side on back of ninth segment; a similar-coloured broken lateral band on the tenth segment, which is continued round base of anal segment, the latter segment with two small pointed fleshy tubercles. Pupa curved anteriorly; head flattened and slightly bifid, thorax conical in front, abdominal somites with short dorsal tubercles. Colour olive-brown.'

PIERIDAE

Catopsilia crocale Cr.

Sevastopulo, *Journ. Bomb. Nat. Hist.*, xl, 394. 1938.
Talbot, *Fauna Brit. Ind.*, Butterflies (2nd edit.), i, 491. 1939.

A large number of larvae bred in Calcutta in July 1942 all had the usual black lateral line expanded into a wide dorso-lateral stripe, varying both in width and in depth of colour. In some examples the dorsum was also suffused with blackish.

Whilst not wishing to re-open the controversy of whether *C. crocale* L. and *C. pomona* F. are conspecific or not, it is worth recording that a number of larvae reared from ova found on *Cassia fistula* L., the reputed favourite food-plant of *C. pomona*, in the hope that they would prove to be this species, all turned out to be *crocale*. Also young *crocale* larvae, found on a small plant of one of the pink-flowered Cassias, fed up readily and well on *Cassia fistula*.

HETEROCERA

LYMANTRIIDAE

Caragola ochripes Moore

Gardner, *Indian Forest Records*, iii, 202, figs. 9, 20, 21. 1938.

Head pale orange. Body with the dorsum pure white, minutely streaked and speckled with black. 1st somite with four crimson tubercles, the outer pair larger and tufted with longish white hair. 2nd and 3rd somites each with six small orange tubercles tufted with short white hair. 4th and 5th somites each with paired dorsal brushes consisting of a ring of short thick rose-pink hair surrounding a dark tubercle with a pale glandular apex. 6th somite with a dorsal tuft of very short white hair and a minute orange wart with a rosette of short white hair. 7th to 9th somites each with two pairs of these orange warts with white hairs. 10th somite with similar warts but the hairs deep yellow. 11th somite with a dorsal tuft of short pale yellow hair. 12th somite deep yellow. A series of sublateral yellow tubercles bearing fringes of long white hair, the area below these tubercles pale yellow. Legs and prolegs pale yellow. Venter pale yellow slightly tinged with grey. Dorsal glands yellow.

Pupa under a few netted threads spun across the hollow of a leaf. Ivory white, the dorsum tinged with olive brown. A chestnut patch at the base of the wing case. Dorsum of abdomen, just behind the broadest part, with two pairs of blackish dorsal spots. A tuft of longish pale grey hair from the head, two groups of three long spatulate black hairs from the abdomen just above the wing cases, and another group towards the cremaster. Venter clad with longish white hair. Dorsum of abdomen with three paired tufts of short brownish hair and one of white. Wing cases slightly black-veined.

Food-plant—Gardner gives *Litsea polyantha* Juss., *L. chinensis* Lam. and *Phoebe lanceolata* Nees, all *Lauraceae*.

Described from a full fed larva found in Shillong 24-iv-41, pupated 13-v-41, and a female emerged 21-v-41.

LASIOCAMPIDAE

Metanastria hyrtaca Cr.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 406. 1938.

Subramanian & Anantanarayanan, *Journ. Bomb. Nat. Hist. Soc.*, xl. 257. 1938.

Ovum almost spherical. Chalky white, the micropyle a dark chocolate-brown spot, and a large dark chocolate-brown spot on either side of the ovum. Laid in small batches.

A fairly powerful hand lens did not reveal the fine sculpturing and the irregular dirty grey faint markings mentioned by Subramanian and Anantanarayanan.

EUPTEROTIDAE

Eupterote undata Blanch.

Head dull black, the clypeus filled in with creamy-white and with a broad creamy-white stripe from apex of clypeus to vertex and extending along the back of the head; a fringe of short, dark golden-brown hair above the mandibles. Body very dark brown, the intersegmental areas almost black. A subdorsal and sublateral dark pinkish line. Clothed fairly thickly with longish, pale-tipped, dark brown hair, growing in spreading tufts subdorsally, laterally and sublaterally. The dorsal area on the abdominal somites clothed, in addition, with large patches of very short, black-brown hair. Spiracles pinkish. Venter dark brown, not hairy. Legs dark brown. Prolegs yellowish-flesh colour.

Cocoon of dark brown, closely woven, rather papery silk, with an inner cocoon of dark brown silk interwoven with larval hair. Pupa dark mahogany, very shiny, the abdominal somites very minutely punctate. Cremaster closely covered with golden, short, hooked spines. The divisions between the leg, antenna and wing cases not well marked.

Food-plant—*Quisqualis indica* L., *Lantana camara* L., *Alseodaphne semicarpifolia* Nees. and numerous other trees and shrubs. One larva was even found feeding on a coarse, ornamental Grass.

Described from a full fed larva found in Calcutta 16-xi-41, spun 19-xi-41, and a female emerged 29-vi-42.

Eupterote geminata Wlk.

Penultimate instar—Head terra-cotta, a black mark on either side low down and a double black spot just above the clypeus. Body with a broad, pale brown, dorsal stripe with a double, darker, median line, and a broad, blue-grey, dorso-lateral stripe containing two cream lines. A subspiracular cream line. Clothed with long whitish hair. Venter cream with a purplish-black lateral stripe. Legs chestnut. Prolegs pink. Spiracles set in pink patches.

Final instar—Similar to the penultimate, but the pale brown dorsal stripe obscured on the abdominal somites by a coating of short, dark brown, silky hair, and the subspiracular line absent. Lateral area brownish. Head with a wavy pale horizontal line above the lower black marks and below the upper, and with a pale inverted V-shaped mark with its apex on the vertex.

The larvae are gregarious, congregating on the trunk and branches of the food-tree in close packed, furry masses by day, and feeding by night. The larvae rest close together, the heads usually pointing in one direction, in slightly curved rows, and may cover an area of two or more square feet. The hairs are extremely irritating and I know of a case where some syces had to desert their usual sleeping place because a tree close by was harbouring these larvae in large numbers.

Pupa in a cocoon of dense greyish-brown silk interwoven with larval hair. Reddish chestnut, the wing cases rather paler. Surface dull, the cuticle densely punctate. The abdominal somites somewhat contracted. Cremaster a fairly long, stout spine armed with a few short bristly hairs.

Food-plant—Various trees and shrubs, among them *Lagerstroemia indica* L.

Described from larva found in Calcutta 19-x-41, one of which spun 26-xi-41, and a female emerged 8-v-42.

SPHINGIDAE.

Theretra pinastrina Mart., *pinastrina*.

Butler, *Proc. Zool. Soc. Lond.*, ix, 560, pl. 92, fig. 8. 1877.

Hamps., *Fauna Brit. Ind.*, Moths, i, 88. 1892.

Mell, *Biol. u. System. der Sudchin. Sphing.*, 310, pl. xi, figs. 12-18 (figs. 18-24), pl. xix, figs. 19-21. 1922.

Seitz, *Seitz Indo-Austr. Bombyces*, x, 567. 1929.

Bell & Scott, *Fauna Brit. Ind.*, Moths, v, pl. vi, figs. 6, 7. 1937.

Ovum—Jade green, of the usual ovoid Sphingid type. Laid singly on the upper or lower surface of a leaf of the food-plant. Hatched 23-viii-42.

1st instar—Head round, green. Body green, at the end of the instar with a yellowish white subdorsal line only visible under a lens. Horn shorter than in most first instar Chaerocampid larvae, straight, black, the base reddish-orange, the tip slightly bifid. Moulted 25-viii-42.

2nd instar—Similar but with a minute black dot on the subdorsal line on somites 4 to 9, the spot placed about one-third of the somite's length from the anterior edge. An indistinct bluish dorsal line. Horn reddish. Moulted 27-viii-42.

3rd instar—Similar, but colour rather yellower green and speckled minutely with yellow. An additional black dot on the 10th somite, and all ringed with whitish later in the instar. Horn short, dark pink. Fore part of the body slightly tapered. Moulted 29-viii-42.

4th instar—Variable, the usual form similar to the preceding instars, but with the black spots enclosed in an oval ring, bluish white above and yellowish below, the whole edged with a black line. Horn shorter comparatively. Legs pinkish. Another form has a suffused reddish-brown stripe above the subdorsal line from the ocellus on the 6th somite to the base of the horn. A third form has the whole dorsum between the subdorsal stripes suffused with rufous. A fourth form has the green colour, including the head, replaced by rufous. These last three forms with the prolegs deep pink. A fifth form has the head and body dark chocolate brown, a narrow, double, paler stripe on the dorsum and a paler lateral stripe. Ocelli with the pupil black, the iris whitish, the whole enclosed in a black ring. Horn blackish brown. Legs, prolegs and venter brownish pink. Moulted 31-viii-42.

Final instar—Bred green form—Head green. Body yellow green. 4th somite with a small round subdorsal ocellus, consisting of a round black pupil surrounded by a greenish-white iris, the whole ringed by a black line. 5th to 9th somites with larger, similarly coloured, but oval, ocelli, the upper edge more convex than the lower. 10th somite with the ocellus reduced to the black pupil only. Legs pink. Prolegs deep pink. Spiracles purple with the ends whitish. Horn very short, straight, smoky at the sides, pinkish above, the extreme tip yellow.

Bred dark form—Head dull brownish olive, with a darker stripe each side of the clypeus, and speckled with paler. Body purplish brown, a dark chocolate brown median line, a dark chocolate brown, broad subdorsal stripe from head to base of horn and narrowing at both ends; the lateral area with a narrow whitish stripe above and below, tinged with chocolate brown on the thoracic somites and speckled throughout with whitish. Ocelli placed as in previous form and cut by the lower edge of the subdorsal stripe; the pupil black, the iris whitish and narrow above, deep yellow and slightly wider below, the whole encircled by a black line. Legs pink. Venter and prolegs very dark chocolate. Spiracles black with the ends yellowish. Horn with the upper surface orange, the sides dark chocolate, the extreme tip orange with a dark chocolate ring below. Pupated 5-ix-42.

There is a considerable amount of variation in the tint of the ground colour and in the degree of contrast between the dark and pale areas. In some examples the chocolate colour is tinged with olive, in others with reddish chestnut. Normally the dorsal and lateral areas are the same colour but the lateral area may be suffused with chocolate; in some examples the dorsal and lateral areas were cream-coloured. One specimen had the dark areas blackish purple, the light areas somewhat paler. The ocelli vary considerably in size. The contrast between the dark and pale areas is most marked early in the instar, later the contrast is reduced and the colours themselves degraded to a muddy or yellowish brown.

Wild green form—Wild green larvae are slightly different to the bred form. Head green. Body yellow green with minute yellow dots. Ocelli the same shape as in the other forms but the pupil blue-green, the iris of those on the 4th, 5th and 10th somites creamy yellow outlined by a black ring, of the remainder orange shading into yellow and outlined by a black ring. One had the ocelli on somites 6 to 8 only with the orange iris. Another had no orange round any of the ocelli and had the outlining black ring much broader above than below. Spiracles mauve with white ends. Legs pink. Venter and prolegs green. Horn green in some examples, pinkish in others, the extreme tip yellow.

Wild brown form—Head golden brown. Body pale golden brown, a dark dorsal line on the thoracic somites. A slightly darker golden brown subdorsal stripe, faintly streaked with dark brown, from head to base of horn and narrowing at both ends. The ocelli with the pupil black, the iris purplish shading into whitish above, and pale orange shading into yellow below, the whole ringed by a black line. Legs pink. Prolegs and venter pinkish brown. Spiracles dark brown, the ends yellowish. Horn dark golden brown, the extreme tip orange. One bred example belonged to this form.

Pupa in captivity in a slight cocoon among litter. In the field a number were found spun up in growing leaves of the Arum on which they had been feeding. Colour pale yellowish bone colour, minutely streaked with dark brown, the abdominal somites with a dark olive dorsal line and a dark olive subdorsal stripe, traces of a dark spiracular stripe, a latero-ventral and median ventral stripe. Wing cases lined with dark brown. Tongue case forming a slight frontal keel. Spiracles protruding slightly. Cremaster short, black and pointed.

Food-plant—Arums of various species. Bell and Scott give *Jussiaea repens* L., *Boerhaavia* and *Aroideae* as food-plants.

Described from larvae bred from ova or found in their first and second instar in Calcutta.

Hampson describes the larva as 'green, with the dorsal area red-brown; a subdorsal paler line with equal sized ocelli from 4th to 10th somites with green centres; horn red brown.' Seitz writes 'Larva green or earth-coloured with lighter lateral stripes, on the 4th to 10th rings dark-centred eyes surrounded by dark; horn small. It chiefly lives on Taro (*Colocasia antiquorum*), also on *Jussieua* (sic)'.

NOCTUIDAE.

Selepa celtis Moore.

Moore, *Lep. E. I. Co.,* 353, pl. 16, fig. 8a. 1858.
Hamps., *Fauna Brit. Ind.,* Moths, ii, 370. 1894.
Hamps., *Cat. Lep. Phal.,* xi, 298. 1912.
Gaede, *Seitz Indo-Austr. Noctuidae,* xi, 396. 1937.
Gardner, *Indian Forest Records,* vi, 276. 1941.

Head black. Body greenish yellow, under a lens with indistinct longitudinal whitish lines. Some examples with traces of a black lateral line. A large black dorsal spot on 5th, 10th and 12th somites. Clothed with longish, single, white hairs, in some examples the hairs on the thoracic somites black. Legs and prolegs greenish yellow. The black dorsal spots do not appear until the penultimate instar. Gregarious.

Cocoon canoe-shaped of tawny silk, and covered with frass, etc. in captivity; in nature probably spun on a branch and covered with bark fragments. Pupa slender, golden yellow, the dorsal area on the abdomen tinged with orange, the lateral with green.

Food-plant—*Lagerstroemia indica* L. Gardner gives the following list, *Shorea robusta* Gaertn., *Eugenia jambolana* Lamb., *Careya arborea* Roxb., *Terminalia tomentosa* W. & A., etc.

Described from a number of larvae found in Calcutta, one of which spun 29-vii-42, and a male emerged 7-viii-42.

Hampson, in the Catalogue, gives the following reference and description:—'Semper, *Reise. Phil., Schmett.*, ii, 529, pl. Q, figs. 12-14—Yellow; head black; dorsal black patches on 5th, 10th and 11th somites; a lateral reddish line with a series of black spots; hairs long and sparse; forms a cocoon covered with faeces.' This description of Semper appears to be the basis of that in the Fauna and also in Seitz. Gardner correctly places the dorsal spots on the 2nd, 7th and 9th abdominal somites, but also mentions a smaller one on the 8th abdominal somite, this latter was absent in my specimens.

Attatha ino Drury

Hamps., *Cat. Lep. Phal.*, xiii 10. 1913.

Head slightly flattened, pale green very slightly tinged with brown. Body pale green, very similar in colour to the young leaves of Peepul on which it feeds, a broad white subdorsal line. The dorsal chord is plainly visible as a dark, pulsating streak. Legs pale green. Prolegs pale green slightly tinged with brown. Spiracles pale buff. The larva is somewhat flattened, particularly the thoracic and posterior somites. Before pupation the ground colour turns purplish pink and the lines fade.

Pupa subterranean in a slight cocoon of earth and silk. Colour dark purple brown, the thorax and wing cases darker, a darker dorsal stripe and the intersegmental areas. Cuticle punctate, the thorax and wing cases more so. Cremaster ending in a pair of divergent spines.

Food-plant—Peepul (*Ficus religiosa* L.).

Described from a full fed larva found in Calcutta 16-iv-42, buried 18-iv-42, and a male emerged 27-iv-42.

Hampson gives the following reference and description:—'*Indian Museum Notes*, v, p. 114, pl. xiii, ff. 6a, b. Yellowish white or dark pink above, yellowish white below; lateral lines pale, more or less distinct; each somite with a few colourless bristles; head dirty white, pinkish, or brown. Food-plant, Pipal. Pupates underground without cocoon'.

Cosmophila sabulifera Guen.

Gardner, *Indian Forest Records*, vi, 288. 1941.

Head yellow green. Body olive green, a darker dorsal line due to the contents of the intestines, a white subdorsal line, a slightly sinuous white lateral line and a sinuous whitish sublateral line. Intersegmental rings yellowish. 1st somite with two dorsal, a subdorsal, and a lateral black dot on the anterior edge and a second series of two dorsal, a smaller subdorsal and lateral immediately behind. 2nd and 3rd somites with a black dot just above the subdorsal line, one between it and the lateral line, and three below. 4th to 11th somite with two dots above the subdorsal line, one between it and the lateral, and two below, the one above and anterior to the spiracles, the other below and posterior. 8th and 9th somites with an additional spot at the base of the proleg. 12th somite similar but with no spots below the lateral line. The black dots all ringed indistinctly with whitish and with a single, short, black bristle. Venter, legs and prolegs rather more silvery green. The first pair of prolegs reduced. Spiracles brown ringed with whitish.

Pupa in a slight cocoon among leaves. Dull olive brown, a darker dorsal stripe on the abdominal somites, the intersegmental areas also darker. Minutely punctate. Cremaster ending in a bunch of golden brown hooked spines.

Food-plant—Gardner gives *Grewia tiliaefolia* Vahl, *G. asiatica* var. *vestita* Wall., *G. laevigata* Vahl and *Eriolaena Hookeriana* Wight and Arn.

Described from a full fed larva found in Calcutta 25-viii-42, pupated 28-viii-42, and a female emerged 3-ix-42.

Gardner gives the following description:—'Head dull yellow, body dull fairly dark green with two fine pale lines along each side. Setiferous rings on white spots themselves encircled by pink. Spiracles white with black rims. Prolegs on A3 abruptly reduced. Labral emargination less than half deep. Length about 30 mm.'

Ericeia (*Polydesma*) *inangulata* Guen.

Head pale brown, reticulated with darker, a white spot on each side of the vertex; or in darker individuals blackish brown speckled with white and with two larger white spots on top of each lobe. Clypeus outlined with orange and with an orange line from apex to vertex. Body tawny brown, an orange dorsal stripe with a double central dotted line, a dark tawny subdorsal stripe sprinkled with minute dark dots and with a series of small white spots—two to each somite, a slightly paler tawny lateral stripe speckled with darker dots, which are more numerous in the middle, below this a darker tawny, dark speckled stripe, and below this again a paler tawny, dark speckled stripe. Venter pale tawny with a dark brown central stripe. Legs orange brown. Prolegs tawny, the feet pinkish, the first pair obsolescent. Spiracles blackish. Head and body with very short, very sparse, black hairs. Some examples are very much darker, the dark tawny stripes being almost black. When young very Geometer-like.

Pupa, in captivity, in a cocoon spun under a leaf and covered with earth. Rather slender, reddish brown, thorax and wing cases slightly darker, intersegmental areas darker. Pruinosed spiracles black. Apex of abdomen longitudinally wrinkled, the cremaster consisting of two longish, stout, hooked spines with a number of shorter and finer spines behind.

Food-plant—*Cassia fistula* L.

Described from a full fed larva found in Calcutta 29-vii-42, pupated 2-viii-42, and a male emerged 10-viii-42.

GEOMETRIDAE.

Scopula cleoraria Wlk.

Head pale brown with a whitish subdorsal and lateral stripe. Body brownish green, with an indistinct darker dorsal stripe, more noticeable intersegmentally, and a whitish lateral line. 4th and 5th somites with an irregular, dark brown, sublateral spot, in some examples on the 6th and 7th somites also. The intersegmental divisions yellowish. Legs pale brown marked basally with darker. Shape very long and thin, slightly broader posteriorly. Rests extended straight out away from the support, or very slightly curved. The fore part is never coiled up. Turns crimson before pupation.

Pupa in a slight cocoon between leaves, in a state of nature probably among litter. Pupa pale chestnut tinged with green, the wing cases olive green. Spiracles black. Crémaster ending in two stout, longish, divergent, hooked spines, with four finer spines ventrally, last segment of abdomen with a transverse dentate dorsal ridge.

Food-plant—A cultivated Lantana, *L. sellowiana.*

Described from a full fed larva found in Calcutta 25-viii-42, pupated 31-viii-42 and a male emerged 7-ix-42.

PYRALIDAE.

Trachylepidia fructicassiella Rag.

Head chestnut. Body greyish with a chestnut dorsal plate on the 1st somite. Each somite with two pairs of minute black dots on the dorsum. A double lateral series of slightly larger black dots, one below and one above the spiracle. Anal somite marked with blackish. Legs chestnut. Venter and prolegs whitish. Spiracles chestnut ringed with black. A single colourless hair from each of the black spots.

Pupa in a shuttle-shaped cocoon of dense white silk. Venter and wing cases honey colour shading into a very pale chestnut dorsally on the thorax and abdomen. 1st to 8th abdominal somites with two chitinous, blackish, dorsal teeth, those on the 1st to 7th somite slightly apart, on the 8th almost joined.

The larvae live each in a separate compartment in the pod of *Cassia fistula,* but appear to congregate together to pupate, a compartment being completely filled with cocoons and frass.

Food-plant—*Cassia fistula* L., living in the pod and eating the ripe seeds.

Described from a full fed larva found in Calcutta 19-iv-42, pupated 24-iv-42, and a female emerged 29-iv-42.

Pachyzancla aegrotalis Zell.

Head brown. Body yellowish, appearing blue green from the contents of the intestines, a darker dorsal line. 1st and 2nd somites with a subdorsal black spot. A white spiracular line. A few colourless hairs arising from olive green spots, only visible under a lens. Legs colourless. Prolegs yellowish green. Lives in a spun together leaf.

Pupa in a spun together leaf, reddish chestnut, slender.

Described from a full fed larva found in Calcutta 30-vi-42, pupated 2-vii-42, and a male emerged 7-vii-42.

(*To be continued*)

FISH SURVEY OF HYDERABAD STATE.

Part II—Fishes of Hyderabad City and its suburbs.

BY

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Hyderabad City and its suburbs, popularly known as Balda and Atraf-i-balda district, are situated about in the centre of the State. It is surrounded by the districts of Medak and Karimnagar on the north, Mahboobnagar on the South, Nalgonda on the east, Gulbarga on the west and Bidar on the north-east. Its total area is 3,399 sq. miles, including the city of Hyderabad (26 sq. miles). The country is mostly hilly with a few wooded hills, known as the Rajkonda range, extending upto Nalgonda district. Another is the Anantgiri range extending from Mahboobnagar to Dharur near Vikarabad. A large portion of this range is composed of high level laterite; and isolated granite hills are seen everywhere amongst which Moula Ali, the Golconda rock and the Black rock of Trimulgherry are of special interest.

The most important river is the Musi, rising in the Anantgiri hills. It passes through the city and falls into the river Kistna near Wazirabad in the Nalgonda district. The river Manjra touches the district on the N.-W. side. Other smaller streams are the Sakalvani, Haldi, Deo, and the Eesi river.

The geological formation is Archaean Gneiss; tors and boulders of fantastic shapes are seen everywhere, composed of basalt and granite piled up in picturesque confusion.

Series of dams have been formed in the Musi and Eesi, and there are 143 large and about 300 small tanks; but most of the tanks hold water only for about 8 months in the year, some are in disrepair and if properly maintained may become sources of perennial supply. Here, I will deal only with some important perennial reservoirs.

The rainfall is only 30″ and the temperature 62°-96° but it sometimes reaches even 108°. Population including Secunderabad is 16,53,249; number of fishermen 41,463.

Himayatsagar, with a water spread of 14.7 sq. miles is situated south-west of the city about 12 miles away. It is a dam of the Eesi river and two big 'nalas' also fall into it; its water is taken into the Meer-Alam tank by means of a channel and then supplied to the old part of the city. The margins are weedy, but the bottom is full of submerged boulders. The dam is 7,463 feet long with 17 automatic flood gates.

The methods of fishing are very primitive and practised in shallow water; fishing is done by means of long lines also, but owing to the presence of otters very few fishes are found intact in the morning when the line is taken out;

usually only the heads remain on the hooks. This reservoir contains much fish, and below is given the list of fishes obtained during the survey:

Notopterus notopterus (Pallas).
Notopterus sp. nov.
Mastacembelus armatus (Lacép.).
Chela clupeoides (Bloch).
Rasbora daniconius (Ham.).
Barbus (*Puntius*) *kolus* (Sykes).
Barbus (*Puntius*) *sarana* (Ham.).
Barbus (*Puntius*) *sophore* (Ham.).
Barbus (*Puntius*) ticto (Ham.).
Cirrhina reba (Ham.)
Labeo calbasu (Ham.).
Labeo fimbriata (Bl.)
Glossogobius giuris (Ham.).
Ophicephalus marulius Ham.
Ophicephalus striatus Bl.
Heteropnestes fossilis (Bloch).
Wallagonia attu (Bl.).

Osmansagar (water spread area 16.22 sq. miles), about 11 miles west of the city, is the main source of water supply. The bottom is full of boulders; vegetation is scanty. It is formed by damming the Musi river which is a tributary of the Kistna. The dam is 6,3000 ft. long with 45 flood gates. The water level in this reservoir has gone down considerably during the last five years owing to scanty rainfall. The predominant fishes are the two varieties of carps, *Labeo calbasu* Ham. and *Labeo fimbriata* (Bl.). It is not open for netting; only angling is allowed.

List of fishes obtained:

Notopterus notopterus (Pallas).
Notopterus sp. nov.
Mastacembelus armatus (Lacep).
Chela clupeoides (Bl.).
Barilius barna (Ham.)
Barilius bendelisis Ham.
Rasbora daniconius (Ham.).
Barbus (*Puntius*) *sarana* (Ham.)
Barbus (*Puntius*) *ticto* Ham.
Cirrhina reba (Ham.).
Labeo boggut (Sykes).
Labeo calbasu Ham.
Labeo fimbriata (Bl.).
Labeo potail (Sykes).
Glossogobius giuris (Ham.).
Ophicephalus marulius Ham.
Thynnichthys sandkhol (Sykes).
Rohtee belangeri Cuv. & Val.
Callichrous bimaculatus (Bloch).

Meer-Alam tank is about 4 miles south west of the city, and is a beautiful sheet of water; it is 8 miles in circumference. The dam consists of a series of 21 semi-circular retaining walls with their convex sides facing the water; its total length is 1,120 yards, and it was constructed by French engineers at a cost of 8 lakhs, during the time of Nawab Meer Alam; it is the main source of water supply to the old city. The margins are very weedy but the deeper parts are devoid of vegetation. It is noted for its rohu (*Labeo calbasu*) Ham. and 'phool-murrel', *Ophicephalus marulius* Ham. Only angling is allowed, but being near the city it is a great attraction for poachers.

Fishes obtained during survey:

Notopterus notopterus (Pallas).
Notopterus sp. nov.
Mastacembelus armatus (Lacép).
Rasbora daniconius (Ham.).
Barbus (*Puntius*) *kolas* (Sykes).
Barbus (*Puntius*) *sarana* (Ham.).
Barbus (*Puntius*) *sophore* (Ham.).
Barbus (*Puntius*) *ticto* (Ham.).
Labeo calbasu Ham.
Glossogobius giuris (Ham.).
Rohtee cotio var. *cunma* Day.
Ophicephalus marulius Ham.
Ophicephalus punctatus Bl.
Ophicephalus striatus Bl.
Callichrous malabaricus C.V.
Heteropneutes fossilis (Bloch.)
Clarias batrachus Linn.
Wallagonia attu (Bloch).

Hosainsagar is a large sheet of water which when full extends over an area of 8 sq. miles; it lies between Secunderabad and Hyderabad. It supplies unfiltered water to the Osmania University and to gardens of Hyderabad and Secunderabad. The dam is 2,500 yds. long and forms the road between the two cities. It was built by Sultan Ibrahim Kutb Shah about 1575 A.D. It is fed by 'Balkapur nala' running from the river Musi near Shankerpalli, and a small feeder channel known as 'Begampet nala' brings flood water from the adjacent hills during the rains. The stocking of the reservoir is not satisfactory, and if artificial means are not resorted to the finny population will gradually diminish and the rentals will fall within a few years. If the fisheries of this reservoir are developed on proper scientific lines they can be a great source of supply to the city markets.

It contains much vegetation, and its 'rohu' (*Labeo calbasu* Ham.) is of excellent taste. Other fishes are :

Mastacembelus armatus (Lacép).
Mastacembelus pancalus (Ham.).
Chela clupeoides (Bloch).
Rasbora daniconius (Ham.).
Rasbora buchanani Bl.
Barbus (*Puntius*) *dorsalis* (Jerdon).
Barbus (*Puntius*) *kolus* (Sykes).
Barbus (*Puntius*) *sarana* (Ham.)
Barbus (*Puntius*) *sophore* Ham.
Barbus (*Puntius*) *terio* (Ham.).
Barbus (*Puntius*) *ticto* Ham.
Brachydanio rerio (Ham.).
Labeo calbasu Ham.
Labeo fimbriata (Bl.).
Glossogobius giuris (Ham.).
Ophicephalus gachua Ham.
Ophicephalus marulius Ham.
Ophicephalus punctatus Bl.
Ophicephalus striatus Bl.
Mystus vittatus (Bloch).
Mystus cavasius (Ham.)
Wallagonia attu (Bloch).

Danio aequipinnatus (McClelland). Young fry of *L. fimbriata* measuring 1″-2½″ were obtained in the month of August from the upper reaches of 'Begumpet nala'.

Ibrahimpatan tank is about 20 miles from the city in the Baghat district, and has a water spread of about 6 miles when full. It was formerly fed by a channel from the river Musi but now this is in disrepair and hence the water level has gone down very low. It was noted for 'Murrel', but owing to the paucity of water it is being gradually overfished. At the time of the survey the water was very low and only about a sq. mile in area.

Notopterus notopterus (Pallas).
Rasbora daniconius Bl.
Amblypharyngodon mola (Ham.).
Barbus (*Puntius*) *dorsalis* (Jerdon).
Barbus (*Puntius*) *sophore* Ham.
Barbus (*Puntius*) *ticto* Ham.
Ophicephalus punctatus Bl.
Ophicephalus striatus Bl.
Mystus vittatus (Bloch).

Notopterus sp. nov.

Notopterus sp., Rahimullah and Das.
Bull. Soc. Portug., *Vol. XII*, *No.* 18, *pp.* 135-141.

It is found in large numbers along with *Notopterus notopterus* (Pallas) but differs from it in many characters. Below I give the fin formula and other characters which identify it as a new species.

B=VII; D=8-10; P=14-15; V=5; A+C=101-117; Ll.%180.

A distinct concavity on the head: (no concavity in *N. notopterus*); serrations exist along the lower surface of the preorbital, 28-31 serrations; the maxilla extends from ½ to 2/3 of the diameter of the orbit, and below the latter; the dorsal fin commences much nearer to the tail fin than to the snout.

The characters are intermediate between those of *N. notopterus* (*N. kopirat*) and *N. chitala* Day.

Labeo calbasu Ham.

Labeo calbasu (Ham. Buch.) Day, *Fauna Brit. Ind.*, Vol. I, pp. 259-260.

Day has described the colour as blackish; sometimes, especially in examples from clear streams, many of the scales have a scarlet centre.

The colouration was noted in fresh specimens from the same locality, and two varieties have been obtained; one is more or less black and the spots on the scales are not very distinct, but in the other variety the colour is silvery with scarlet spots on the scales, whilst in *L. fimbriata* there are orange bloches on some scales.

Brachydanio rerio (Ham.)

Brachydanio rerio, Prashad and Mukherji, *Rec. In. Mus.*, Vol. xxxi, pt. iii, pp. 206-208.

Brachydanio rerio, Hora, *Ibid.*, Vol. xxxix, pt. I, pp. 8 and 15.

Brachydanio rerio, Bhimachar and Rau, *J. Mys. Un.*, Vol. 1, pt. xvi, pp. 146 and 152.

The specimens were collected in large numbers from Hosainsagar and its feeders. They agree in all characters with those described by Bhimachar and Rau. Lateral line and lateral line organs are absent. The fins are diaphanous. Upper half of the body is yellow and there are five steel-blue bands separated by yellow ones in the upper and by silvery bands in the lower half. Four horizontal bands on the anal, 3 distinct and two lighter ones on the caudal; pectoral and ventral fins yellowish. It has proved to be a very good larvicidal fish.

Thynnichthys sandkhol (Sykes).

Thynnichthys sandkhol, Day, *Fauna. Brit. Ind.*, Vol. I, p. 289.

Length of head $4\frac{3}{4}$, height of body $3\frac{3}{4}$ in the total length. Eye 4 in the length of the head, 2 diameters apart.

In colouration and other respects it is the same as described by Day.

Rohtee belangeri (Cuv. & Val.).

Rohtee belangeri, Day, *Fauna. Brit. Ind.*, Vol. I, p. 342.

It differs in its measurements from those given by Day.

Length of head 7, height of body $2\frac{3}{4}$ in the total length. Eye: head—$3\frac{1}{2}$, $1\frac{3}{4}$ diameters from end of snout $2\frac{3}{4}$ diameters apart.

This fish is commonly found in all parts of the dominions.

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THE MEDICINAL AND POISONOUS LINDENBLOOMS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The TILIACEÆ are trees or shrubs, rarely herbs. Most of them are tropical; a few inhabit the temperate northern hemisphere, and some are found behind the tropic of Capricorn; but none extend into the Arctic Circle, or ascend to great mountain elevations. The 380 species are distributed into 35 genera.

In general the leaves are mucilaginous and emollient; the bracts and flowers are aromatic, antispasmodic, and slightly sudorific. The bark may be bitter and astringent.

Among the products obtained may be mentioned :— (1) *a volatile oil*; (2) lævo-rotatory *phytosterols*; (3) *vanillin*; and (4) *glucosides*—capsularin, corchorin, tiliacin—.

The medicinal and poisonous Lindenblooms of the world belong to 12 genera: ANCISTROCARPUS (tropical West Africa); CISTANTHERA (tropical Central and West Africa); CORCHOROPSIS (Japan, China); CORCHORUS (warm regions); ELÆOCARPUS (tropical); GLYPHÆA (tropical Africa); GREWIA (Asia, Africa, Australia; mostly tropical); LUEHEA (tropical America, West Indies); SLOANEA (tropical); SPARMANNIA (tropical and South Africa); TILIA (northern temperate regions); TRIUMFETTA (tropical).

The medicinal and poisonous Lindenblooms of India belong to 4 genera: CORCHORUS, ELÆOCARPUS, GREWIA, TRIUMFETTA.

A. Anthers opening by slits.
  I. Petals usually foveolate or glandular at the base; stamens springing from the apex of a raised torus.
    a. Fruit without prickles ... ... GREWIA.
    b. Fruit prickly.
      Herbs or undershrubs. Fruit small ... TRIUMFETTA.
  II. Petals not foveolate or glandular at the base; stamens springing from a contracted torus ... ... CORCHORUS.
B. Anthers opening by a terminal pore.
    Petals sepaloid ... ... ELAEOCARPUS.

CORCHORUS.

The genus consists of 40 species widely dispersed throughout the warm countries of the world.

The following are used medicinally in the Philippine Islands—*C. acutangulus* Lam., *C. capsularis* Linn.—; in Indo-China—*C. capsularis* Linn.—; in Egypt—*C. olitorius* Linn.—; in Gold Coast—*C. acutangulus* Lam.—; in Southern Africa—*C. asplenifolius* Burch., *C. serræfolius* Burch.—.

A. Capsule globose, not beaked ... ... *C. capsularis.*
B. Capsule elongated.
  1. Beak 3-fid spreading ... ... *C. acutangulus.*

II. Beak entire.
  1. Capsule glabrous, cylindric, 10-ribbed. Beak long, erect ... ... *C. olitorius.*
  2. Capsule scabrous or aculeate, 3-angled. Beak short, erect ... ... *C. trilocularis.*

C. Capsule short, beak entire.
  I. Annual. Capsule pubescent, 3-valved ... *C. fascicularis.*
  II. Perennial. Capsule glabrous, 4-valved ... *C. depressus.*

1. **Corchorus acutangulus** Lam. is found throughout the hotter parts of India and Ceylon. It is distributed to Australia, tropical Africa, and the West Indies.

The bitter seeds are given by the Mundas of Chota Nagpur in pneumonia and stomach ache.

In Gold Coast the whole plant, including the root, is used in the form of an injection for urethral discharges.

Akim: Survabiri—; *Awuna*: Lolui-tsu—; *Bengali*: Titapat—; *Ewe*: Have—; *Ibo*: Aheheara, Ahihira—; *Krepi*: Ademademaa, Adomadoma ; *Krobo*: Togatoya—; *Mende*: Ndogbo-ngengele—; *Mundari*: Karigiri, Karijiri, Karijuri, Piritijudiring—; *Tubu*: Koebulu—; *Twi*: Padeedee, Siwabiri—; *Yoruba*: Abojaga, Abo jaja—.

2. **Corchorus capsularis** Linn. occurs throughout the hotter parts of India. It is cultivated in most tropical countries.

A decoction of the dried root and unripe fruit is given in diarrhoea.

In cases of dysentery the dried leaves are eaten at breakfast time with rice. The cold infusion is also administered as a tonic in dysenteric complaints, fever, and dyspepsia.

It is a common practice in the jute-growing districts of Bengal to keep a small stock of the dried jute leaves in the house, whereof an infusion—a so-called tea—is made and taken by those suffering from any disorder of the liver. From the reports received by the Indigenous Drugs Committee it appears that the infusion is used as a popular domestic medicine for disorder of the liver and is of great value when there is a trouble with burning sensation in hands and feet. It is also used as a bitter tonic, stomachic, laxative, carminative, stimulant to increase appetite and flow of saliva and gastric juice; also as an antiperiodic, anthelmintic, astringent and intestinal antiseptic. It has been reported as efficacious in fever, bilious troubles, worms of children, dysentery, hepatic and intestinal colic, gastralgia and gastric catarrh, skin diseases especially itches, atonic dyspepsia, slight jaundice, and in the disorder of the digestive system.

In Indo-China the flowers are given in epistaxis; the fruits are applied to swelling and abscesses, and prescribed in diseases of the bladder.

Assam: Marasag, Titamara—; *Bengal*: Ghinalitapat, Koshta, Narcha Titthapat—; *Bombay*: Chouchen, Ghinaltapat, Narcha—; *English*: Jute—; *Formosa*: Ma-p'i—; *French*: Chanvre de Calcutta, Jute—; *Hindi*: Ghinalita, Koshta, Narcha, Pat—; *Indo-China*: Bo day, Floang ma, Ta ma—; *Marathi*: Chaunchan—; *Mundari*: Hatularita—; *Philippines*: Patas, Ponglopongloan—, *Porebunder*: Borachhunchh, Chhunchh—; *Portuguese*: Juta—; *Sadani*: Larita—; *Sanskrit*: Kalasaka, Nadikapatta—; *Santali*: Kaskomrau—;

Shahjahanpur: Harrawa—; *Sinhalese*: Jaladara—; *Tagalog*: Pasaonabilog—; *Tamil*: Pirattikirai—; *Visayan*: Lamhay—.

3. **Corchorus depressus** Stocks is found in the Punjab, Sind, Baluchistan, Cutch, Gujerat, Deccan. It is distributed to Afghanistan, Arabia, North Africa, Cape Verde Islands, and tropical Africa.

The plant has tonic properties. It is given as a cooling medicine in fever.

The mucilage is used in Sind for gonorrhoea.

The leaves are emollient. The Baluchis make a cooling drink out of them. In Jaisalmer and Jodhpur they are applied to wounds, and a decoction is said to be efficacious in cases of skin eruption.

The seeds in decoction, with milk and sugar, are given as a tonic.

Arabic: Ueki—; *Baluchistan*: Mandira, Munderi, Mundheri—; *English*: Shrubby Jute—; *Gujerati*: Bahuphali, Bethibahuphali, Chhikni, Chhunchh—; *Hindi*: Baphuli—; *Marathi*: Bahuphali—; *Punjab*: Babuna, Bahuphalli, Bophalli, Kurana—; *Rajputana*: Hadekakhet—; *Sanskrit*: Bhedani, Chanchu, Katuka, Kshudra, Ksudrachanchu, Patupatrika, Shunakuchanchuka, Tvakasara—; *Sind*: Mudhiri, Munderi—; *Uriya*: Bojoromuli—.

4. **Corchorus fascicularis** Lam. occurs throughout the hotter parts of India. It is distributed to tropical Africa and Australia.

It is very mucilaginous and somewhat astringent, and is valued as a restorative.

In Bombay, a watery extract, mixed with sugar-candy, is taken as a nutritive tonic.

Bengal: Banpat, Bilnalita, Janglipat—; *Bombay*: Bhauphali, Hirankhori, Mothibahuphali—; *Gujerat*: Chhunchhadi, Ubhibahuphali—; *Hindi*: Bankostoa, Janylipat, Khetapat—; *Marathi*: Hirankuri, Motibuhuphali—; *Poona*: Mayarmithi—; *Porebunder*: Chhunchhadi, Ubhibahuphali—; *Sanskrit*: Bhirupatrika, Chanchu, Chanchuputra, Chanchura, Chhunchhu, Chincha, Diaghpatri, Kalabhi, Kshestrachhunchhu, Kshestrasambhava, Sushaka, Vijala—.

5. **Corchorus olitorius** Linn. is generally distributed by cultivation in all tropical countries. The chief seat of its Indian cultivation is near Kulna in the Burdwan district of Bengal.

The dried plant, roasted and powdered, is used in visceral obstruction. In South India it is used as a demulcent.

The leaves are demulcent, tonic and diuretic, useful in some cases of chronic cystitis, gonorrhoea and dysuria.

The leaves and tender shoots are eaten, and in the dried state, known as *nalita*; they are used in infusion by the natives as a domestic medicine, being tonic and slightly febrifuge, and hence used as a fever drink.

The dried leaves are sold in the market. A cold infusion is used as a bitter tonic, and is devoid of any stimulating property. It can be safely given to patients recovering from acute dysentery to restore the appetite, and improve the strength.

The seeds are purgative. In Egypt they are put into the eye to cause inflammation by way of malingering.

Abeokuta: Eyo—; *Arabic*: Melochia, Meloukhia, Meluhhije, Molochia, Molukhyia, Muluhhije—; *Awuna*: Ademe—; *Bengal*: Banpat, Bhungipat, Phunjipat, Koshta, Lalitapat, Pät—; *Berar*: Chooich—; *Bombay*: Chhunchh, Motichhunchh, Tankla—; *Efik*: Etinyon—; *Egypt*: Melukhiye—; *Ekoi*: Etinyung—; *English*: Jew's Mallow, Jute, Long-fruited Jute—; *Ewe*: Sigli, Singili, Singli—; *Fanti*: Otoro, Oturo—; *French*: Corète, Corette, Corette potagère, Guimauve potagère, Mélochie—; *Fulani*: Lolo, Lolo memel—; *Ga*: Otoro, Oturo—; *Gambia*: Alo—; *German*: Gemuese Corchorus—; *Greek*: Corchoros—; *Gujerati*: Chhunchho—; *Hausa*: Lalo, Malafiya, Marafiya, Tungurnuwa—; *Hindi*: Banpat, Koshta, Pata, Sanpat, Singinjanasha—; *Ho*: Hatempa—; *Ibo Owerri*: Ahu hara—; *Ijebu-Ode*: Ayo—; *Ilesha*: Yoyo—; *Iraq*: Malukhiyah—; *Kanuri*: Darraba, Gamgaino—; *Katsina*: Turgunnuwa—; *Kissi*: Yo-ngengeyo—; *Konno*: Kokoe—; *Kratchi*: Aposse—; *Lagos*: Ewedu—; *Mandingo*: Kiringere—; *Marathi*: Chunch, Motichunch—; *Mende*: Gingere, Ngenge, Ngengele, Yengei, Yeingei—; *Mundari*: Larita—; *Nimar*: Rajan—; *North-Western Provinces*: Banphal—; *Oloke Meji*: Eyo-ganbi—; *Porebunder*: Chhunchho, Chunchhdo, Motichhunchh—; *Punjab*: Banpat, Banphal—; *Sadani*: Larita—; *Sanskrit*: Brihatchanchu, Dirghapatri, Divyagandha, Kalasa, Mahachanchu, Nadika, Patta, Singgika, Sthulachanchu, Suchanchuka, Vishari—; *Santali*: Birnarcha—; *Senoufo*: Sobo—; *Serere*: a Koud—; *Sherbro*: Krinkrin-de—; *Sierra Leone*: Bush Okra, Crincra, Crincrin, Ingle—; *Sind*: Banpat—; *Sinhalese*: Wanuk—; *Sobo*: Oyoyo—; *Susu*: Suri—; *Tamil*: Peratti, Perumpunnakhuppoondu, Punaku—; *Telugu*: Parinta, Parintakura—; *Timne*: Kenkerin, Kirinkirin—; *Umu Ahia*: Agheregha, Aheheara, Ahihira—; *Uriya*: Jhoto, Joto, Kaunria—; *Wolf*: Mbali—; *Yemen*: Melochia—; *Yoruba*: Ewedu-ga-nbe, Eyo, Eyo-ga-nbe, Oyo—.

6. **Corchorus trilocularis** Linn. is found in Bihar, the Deccan and Carnatic of the Madras and Bombay Presidencies, Khandesh, Gujerat, Cutch, Sind, Baluchistan; whence it extends to Afganistan, Arabia, tropical and southern Africa.

The plant, macerated for a few hours in water, yields a mucilage, prescribed as a demulcent.

The seeds are bitter and administered in doses of about 80 grains in fever and obstruction of the abdominal viscera.

Arabic: Melochia, Molukhiya—; *Arago*: Emakikoho—; *Bombay*: Kaduchhunchh, Kuruchuntz—; *Canarese*: Tanolassir—; *Egypt*: Melukhiye—; *Fulani*: Lalo—; *Gujerati*: Kadvi-chhunchhdi—; *Hausa*: Lalo, Turgunuwa—; *Hindi*: Kadukosta, Kadvapat—; *Malay*: Ramput baya roaza—; *Marathi*: Kaduchunch—; *Nasirabad*: Datrab—; *Porebunder*: Lambichhunchh—; *Rajputana*: Hardikeket, Kaglekitamaku, Karak—; *Sanskrit*: Dirghachanchu, Kaunti, Nadika—; *Sinhalese*: Jahedara, Wanuk—; *Songhai*: al Muluguia—; *Tamil*: Peratti, Punnakkuppoondu, Talakkaippoondu—.

ELÆOCARPUS

The genus numbers 90 tropical species, most abundant in the hotter parts of India and the Indian Archipelago; a few are found in some of the South Sea Islands, New Zealand, and Australia.

E. madepolatus Pierre is used medicinally in Cambodia, *E. photiniaefolia* Hook. and Arn. in Indo-China.

A. Anthers not terminated by an awn.
  I. Drupe 5-celled ... ... *E. Ganitrus.*
  II. Drupe 1-3-celled.
    a. Anthers bearded. Filaments short, straight ... *E. serratus.*
    b. Anthers rarely bearded. Filaments long, twice bent ... ... *E. oblongus.*
B. Anthers terminated by a long awn.
  Leaves obovate. Stone much tubercled ... ... *E. tuberculatus.*

1. **Elaeocarpus Ganitrus** Roxb. is found in the Western Ghats and the Konkan of the Bombay Presidency, Nepal, Bengal, Burma, Siam, the Malay Peninsula and Archipelago.

The fruit is used by Hindu practioners in diseases of the head and epileptic fits.

Bengal: Rudrakya—; *Canarese*: Rudraksha—; *English*: Utrasum Bead Tree—; *Hindi*: Rudrak—; *Malayalam*: Rudraksham—; *Marathi*: Rudraksh—; *Sanskrit*: Amara, Bhutanashana, Harksha, Nilakanthaksha, Pavana, Pushpachanamara, Rudraksha, Sharvaksha, Shivaksha, Shivapriya, Trinameru—; *Tamil*: Akkam, Irattaiyuruttirasham, Kaurichangamani, Uruttiradcham, Uruttirakkam—; *Telugu*: Rudrachallu—; *Tulu*: Rudraksha—; *Uriya*: Rudrakhyo—.

2. **Elaeocarpus oblongus** Gærtn. occurs in the Western Peninsula, and in Malaya.

The fruit is used as an emetic.

Badaga: Bikki—; *Canarese*: Bikki, Hanaltadi, Hanillatade, Hennalatade—; *Malayalam*: Kattakara, Malankara—; *Tamil*: Kattukkarai—; *Visayan*: Cabalte, Cabilte—.

3. **Elaeocarpus serratus** Linn. is found in the Western Peninsula, Ceylon, and Malaya.

The leaves are used in rheumatism, and as an antidote to poison.

The fruits are prescribed in dysentery and diarrhœa.

Bengal: Jalpai—; *Canarese*: Bigada, Guddarenje, Perinkara—; *English*: Wild Olive—; *Hindi*: Jalpi—; *Malayalam*: Avil, Karamavu, Nallakara, Perunkara, Valiyakara—; *Sanskrit*: Chiribilva—; *Sinhalese*: Weralu—; *Tamil*: Ulangarai, Uruttiracham—; *Tulu*: Rahubija—; *Uriya*: Jolopari—.

4. **Elaeocarpus tuberculatus** Roxb. is found in the Western Peninsula, and in Malaya.

A decoction of the bark is given in vomiting of blood, and in biliousness.

The nuts are used in rheumatism, typhoid fever, and epilepsy.

Badaga: Rudraksha—; *Canarese*: Bhutali, Dandele, Dandla, Rudrak, Rudraksha, Rudrakshi—; *Hindi*: Rudrak—; *Kadir*: Navati, Pagumbal, Pillahi, Pulandi—; *Malayalam*: Ammakkaram, Kotuvasi, Maggara, Nakara, Navati, Pillahi, Pulanthi—; *Mysore*: Danala—; *Tamil*: Pagumbal, Rudraksham, Uruttracham—.

GREWIA

The genus numbers 150 species spread over Asia, Africa and Australia, mostly tropical.

Mucilaginous and demulcent, useful in the treatment of diarrhœa and dysentery.

The following are used medicinally in Indo China—*G. paniculata* Roxb.—; in the Philippine Islands—*G. paniculata* Roxb., *G. umbellata* Roxb.—; in Australia—*G. hirsuta* Vahl—; in Tropical Africa—*G. carpinifolia* Juss., *G. mollis* Juss., *G. populifolia* Vahl, *G. villosa* Willd.—; in South Africa—*G. occidentalis* Linn.—.

A. Inflorescence terminal and axillary (sometimes extra-axillary). Flowers in umbellate cymes
    I. Scandent shrubs. Torus long. Drupes obscurely lobed, purple ... ... *G. umbellata.*
    II. Shrubby. Torus short. Drupes yellowish, generally 2-lobed, lobes the size of a small pea, orange-red ... ... *G. populifolia.*

B. Inflorescence leaf-opposed and axillary. Leaves glabrous
or nearly so ... ... *G. tenax.*

C. Inflorescence axillary (rarely extra-axillary).
I. Leaves usually hoary, at least beneath.
Leaves 5-6-nerved
1. Stipules leafy, auricled ... ... *G. tiliaefolia.*
2. Stipules linear-lanceolate ... ... *G. asiatica.*

II. Leaves not hoary beneath, orbicular.
Anthers glabrous

a. Drupes with a crustaceous rind
1. Leaves 3-6 by 4 in. ... ... *G. sclerophylla.*
2. Leaves 3 by 1½ in.; petiole ¼ in. ... *G. carpinifolia.*
3. Leaves 1-3 in.; petiole ½-1 in. ... *G. villosa.*
b. Drupes fleshy. Flowers polygamous.
Branched shrub. Stamens more than 40 ... *G. hirsuta.*

D. Inflorescence terminal, in panicled cymes.
Flowers involucrate.
I. Petals oblong, entire or shortly emarginate.
Thrice shorter than sepals ... ... *G. Microcos.*
II. Petals entire, much shorter than sepals ... *G. paniculata.*

1. **Grewia asiatica** Linn. is cultivated throughout India. The fruit is a well-known Ayurveda medicine credited with astringent, cooling, and stomachic properties.

An infusion of the bark is used as a demulcent. The Santals use the root-bark for rheumatism.

The leaf is employed as an application to pustular eruptions, and the bud is also prescribed by native practitioners.

Ajmere: Dhamni—; *Arabic*: Phalasah—; *Bengal*: Phalsa, Shukri—; *Burma*: Pintayaw, Tagaw—; *Bombay*: Phalasi—; *Canarese*: Buttiyudippe, Jana, Tadasala—; *Central Provinces*: Dhamru, Dhamun—; *Deccan*: Phulsha, Pulsha—; *Gujerat*: Phalsa—; *Hindi*: Dhamin, Karra, Parusha, Phalsa, Pharvah, Pharsa, Phulsa, Shukri—; *Kohlu*: Fistawan—; *Kolami*: Gonyia, Singhindamin—; *Konkani*: Phalsi—; *Kotra*: Pharwan—; *Malayalam*: Chadicha—; *Marathi*: Phalsi—; *Nepal*: Sialposra—; *Newari*: Fussi—; *North-Western Provinces*: Dhaman, Phalsa, Pharsiya—; *Parbut*: Fulsa, Fursu—; *Persian*: Falseh, Palasah—; *Punjab*: Phalsa, Phalso, Pharoah, Phalue—; *Pushtu*: Pastaoni, Shikarimaiwah—; *Sanskrit*: Alpasthi, Dhanvanchhada, Giripilu, Mriduphala, Nagadalapam, Nilacharma, Nilamandala, Parapara, Paravata, Parusha, Parushaka, Porusha, Purusha, Roshana—; *Santal*: Jangolat—; *Sind*: Phalsa, Phalso, Pharaho, Pharoah—; *Sinhalese*: Dowaniya, Hin-damaniya—; *Tamil*: Palisa, Tadachi, Unnu—; *Telugu*: Jana, Nallajana, Peddajana, Phutiki, Putiki—; *Urdu*: Phalasah—; *Uriya*: Pharosakoli—.

2. **Grewia carpinifolia** Juss. is found in the Western Peninsula and is distributed to Tropical Africa.

In West Tropical Africa the plant is used medicinally or to combine with other medicines. Women use it in washing the hair to remove or prevent lice, and put the roots in soup when approaching childbirth.

In East Tropical Africa the broth obtained by boiling the head of a kid in a decoction of the root is taken in cases of diuresis and polyuria.

Ashanti: Ntabanu—; *Ewe*: Gayalige, Tupoetupoe—; *Fanti*: Nkukumbe, Ntaanta—; *Ga*: Asegetete-ntaata, Asegremi-tsho—; *Gosha*: Donoi—; *Krobo*: Akpe-tsho—; *Somali*: Debi—; *Yoruba*: Itakun okere—.

3. **Grewia hirsuta** Vahl occurs in the sub-Himalayan tract up to 4,500 feet from the Indus eastwards, the Salt Range, Bihar, Orissa, Burma, the southern Provinces, and Ceylon. It is distributed to North Australia.

The fruit is employed as a medicine by the Santals, in diarrhœa and dysentery. The root pounded is also prescribed for the same diseases, and powdered in water is applied externally to hasten suppuration, and as a dressing for wounds. The paste dries and forms a hard coating, thus effectually excluding air from the raw surface.

This plant is used by the aborigines of North-Western Australia as a remedy for dysentery.

Arabic: Kamafetusa—; *Australia*: Plain Currant—; *Betul*: Kharota—; *Bombay*: Gowali, Gowli—; *Burma*: Kyettayaw—; *Canarese*: Chikkudippe, Jana, Udippe—; *Hasada*: Setalele—; *Hindi*: Gursukri, Kakarundah, Kukurbicha—; *Kharwar*: Gursukri—; *Kolami*: Setaandir, Setabeli, Setakata—; *Marathi*: Govli—; *Merwara*: Phrongli—; *Naguri*: Seta-bili, Seta-kata—; *Persian*: Karafasrumi—; *Porebunder*: Khoddhramani—; *Queensland*: Karoom, Kooline, Ouraie—; *Santal*: Setaandir, Setabeli, Setakata—; *Tamil*: Tavidu—; *Telugu*: Bidarachipuru, Budda, Chinnachipuru, Chipuru, Chittijana, Jibilike, Muvalchu, Tellajana—; *Urdu*: Kakarundehrumi—; *Uriya*: Kulo, Sonaranga—

4. **Grewia Microcos** Linn. occurs in Eastern Bengal, Assam, Burma, the Western Peninsula, Mysore, and Ceylon. It is distributed to Java and China.

The plant is much used medicinally; it is given for indigestion, eczema and itch, smallpox, typhoid fever, dysentery, syphilitic ulceration of the mouth.

Bombay: Ansale, Shiral—; *Burma*: Myaza—; *Canarese*: Abhhrangu, Biliyabhhrangu, Majjigesoppu—; *Malayalam*: Kottakka—; *Sinhalese*: Keliya—; *Tamil*: Kadambu, Visalam—; *Tulu*. Abroni—.

5. **Grewia paniculata** Roxb. is common in the Malay Peninsula and in Indo-China, in open country.

In the southern parts of Indo-China a decoction of the roots is given as a cure for cough.

Indo-China: Co ke, Poplear thom—; *Malay*: Chenderai hutan—; *Visayan*: Bangalad—.

6. **Grewia populifolia** Vahl extends from the arid tracts of the Punjab, Sind, Rajputana, and Western India, down to the Nilgiri Hills. It is distributed to Afghanistan, Arabia, tropical Africa, Mauritius.

A mucilage of the bark is used by the women of West Tropical Africa to cleanse the hair of vermin.

Somali women take a decoction of the roots to incite the foetus in the womb and thus ascertain that it is alive.

Falor: Sonne—; *Gosha*: Moris—; *Kohat*: Shikari mewa—; *Kolami*: Bursa—; *None*: Sonne—; *Punjab*: Ganger, Gangi, Kanger, Khircha, Inzarre—; *Pushtu*: Khircha, Madzar—; *Rajputana*: Ganegam, Gangan, Gangerun—; *Serere*: Nghel, Nguel—; *Sind*: Gangi, Gango—; *Somali*: Morio—; *Telugu*: Gundukadira, Kadadari, Kaladi, Kattekolupu—; *Tuareg*: Tarkat—; *Tukulor*: Keli, Kelli—; *Wolof*: Kel—.

7. **Grewia sclerophylla** Roxb. occurs throughout the sub-Himalayan tract and outer hills of Kumaon, up to 3,500 feet, Sikkim, Assam, Chittagong, Ava.

The root is prescribed in coughs and irritable conditions of the intestines and bladder. The decoction is also used as an emollient enema.

Bengal: Phalsa—; *Burma*: Petshat—; *Canarese*: Darsuk, Kadukadele—; *Cutch*: Susaka—; *Dehra Dun*: Gurbheli—; *Gujerati*: Padekado—; *Haldwani*: Phalsa—; *Hindi*: Pharsia—; *Kumaon*: Pharsia—; *Marathi*: Khatkhati, Pandharidhaman—; *Mundari*: Gaphni—; *Tamil*: Kattukkadali, Punaippidukkan—; *Telugu*: Bankajana—; *Tharu*: Dapher—.

8. **Grewia tenax** Fiori is found in the Punjab, the desert of Western Rajputana, Sind, Baluchistan, Cutch, Southern Maratha Country, the Deccan and Carnatic of the Madras Presidency, and Ceylon. It is distributed to Afghanistan, Persia, Arabia, tropical Africa, and Mauritius. It is most probably identical with *G. populifolia* Vahl.

A Baluchi medicine for all sorts of diseases and very highly esteemed. The berries are given for colds.

In Jhalawan a decoction of the wood is given as a cure for coughs and pains in the side.

Arabic: Chodar, Moucken, Nabba—; *Baluchi*: Gwangir, Buzi putrunk—; *Brahui*: Gwangir—; *Jhalawan*: Gwangi, Kango—; *Kalat*: Rango—; *Mandi*: Putrunk—; *Rajputana*: Gangeran, Gangerun, Gangi, Gango, Kankeran—: *Sinhalese*: Katuperatti—; *Tamil*: Achu—; *Telugu*: Gundukadira, Kadadari, Kaladi, Kattekolupu—.

9. **Grewia tiliaefolia** Vahl occurs in the sub-Himalayan region from the Jumna to Nepal up to 4,000 feet, Central India, all the districts of the Madras Presidency, Bihar, Orissa, Burma, and Ceylon. It is distributed to East Tropical Africa.

In the Konkan the bark, after removal of the tuber, is rubbed down with water, and the thick mucilage strained from it and given in 5-tola doses, with 2 tolas of the flour of *Panicum miliaceum* (warri) as a remedy for dysentery.

The bark is also employed externally to remove the irritation from cow-itch.

The wood reduced to a powder acts as an emetic, and is employed as an antidote to opium poisoning.

Bengal: Dhamani, Pharsa—; *Bhil*: Dhamnak—; *Bombay*: Damana, Karakana—; *Canarese*: Batale, Butale, Buttele, Dadsal, Jana, Tadagana, Tadasali, Tadasalu, Thadasal, Thadsal—; *Central Provinces*: Damun, Dhaman, Dhamni—; *Ceylon*: Chadachi—; *English*: Dhaman—; *Gond*: Ainlubaranda, Kasul, Khesla—; *Gujerat*: Dalmon, Dhamana—; *Hindi*: Dhaman, Dhamani, Dhamin, Pharsa—; *Kadir*: Chatachi, Una—; *Kharwar*: Dhaman—; *Khond*: Kahal, Karkana—; *Kolami*: Ahsing, Dhamin, Gonyer—; *Konkani*: Butale, Dadsale, Damoni—; *Kumaon*: Pharsia—; *Kurku*: Dhamni—; *Malayalam*: Satchi, Una—; *Marathi*: Daman, Damni, Dhaman, Karavaiani, Karakarani—; *Matheran*: Dhaman—; *Mundari*: Asin, Asindaru, Bengadaru—; *Mayurbhanj*: Kultho—; *Porebunder*: Dhaman, Dharman—; *Sanskrit*: Dhamsi, Dlanuvriksha, Dharmana, Dharwana, Manabala, Pichhilaka, Pichhilatvaka, Raktakusuma, Rujasaha, Ruksha, Swaduphala—; *Santali*: Janoolat, Olat—; *Saora*: Inuputada—; *Sinhalese*: Daminiya, Daminne—; *Tamil*: Sadachi, Tada, Tarra, Una, Unnu—; *Telugu*: Charachi, Ettatada, Jana, Nulijana, Tada, Tadajana, Udupai—; *Tulu*: Kanapadi—; *Uriya*: Bhangia, Dhaman, Dhamono, Dhamuro—.

10. **Grewia umbellata** Roxb. is found in the Malay Peninsula, Siam, and Borneo.

The leaves are applied to cuts and wounds.

Malay: Akar chenderai, Akar kapialu, Akar sekapu, Akar sempelas lida kuching—; *Philippines*: Danloy—.

11. **Grewia villosa** Willd. occurs in the Trans-Indus, the Punjab, Rajputana, Sind, Cutch, Kathiawar, the Deccan and Carnatic of the Madras Presidency from the Kistna southwards. It is distributed to the Cape Verde Islands and tropical Africa.

The juice of the fresh bark is used with sugar and water for gonorrhœa and urinary complaints attended with irritability of the bladder.

The root is employed for diarrhœa in Chota Nagpur.

East of Chad, in tropical Africa, the root is an ingredient in native prescriptions for syphilis and smallpox.

The roots macerated and triturated with milk are a Somali cure for belly ache in babies; the adults apply a poultice to the abdomen, the roots are ground with as little water as possible.

Ajmere: Dhohan—; *Baluchi*: Pachini putrunk—; *Canarese*: Buttigaragale, Garakele, Sannudippe—; *Cutch*: Luskano—; *Ewe*: Adzadze—; *Falor*: Lekit—; *Gujerati*: Padekhado, Parekhado—; *Hausa*: Gwiwar rak 'umi—; *Kamba*: Mugu—; *Kolami*: Gaphni—; *Mangu*: Yumbu—; *Marathi*: Kharmati—; *Merwara*: Dhokelan—; *None*: Ngomen—; *Punjab*: Jalidar, Kaskusri, Thamther—; *Pushtu*: Inzarra, Pastuwanne—; *Rajputana*: Lonkas—; *Santali*: Tarsekolap—; *Tamil*: Kullai—; *Telugu*: Benta, Chenula—; *Tigre*: Hafule, Khafule—; *Wolof*: Horom sap—.

TRIUMFETTA

The genus consists of 75 tropical species.

All the species are mucilaginous, demulcent, bechic, and dieuretic; but those more commonly used are *T. rhomboidea* Jacq. and *T. semitriloba* Linn. generally, and *T. Lappula* Linn. in Guiana.

Fruit the size of a small pea; spines hooked, glabrous or ciliated	*T. rhomboidea.*
Fruit the size of a large pea; spines bristly or shaggy ...	*T. semitriloba.*

1. **Triumfetta rhomboidea** Jacq. occurs in tropical and subtropical India, Ceylon, the Malay Peninsula and Archipelago, from which it extends to China. It is distributed to Africa and America.

The root is bitter and acrid, and used as a diuretic.

The bark and fresh leaves are given in diarrhœa and dysentery.

The leaves, flowers and fruits are mucilaginous and astringent. They are given in gonorrhœa. The fruit is believed to promote parturition.

Zulu women take a hot infusion of the root to facilitate childbirth or to hasten the inception of parturition when it is delayed.

In La Reunion and Mauritius the mucilaginous roots and flowers are used for their demulcent, bechic, and diuretic properties.

The pounded root is applied to sore eyes and to boils in Madagascar; the leaves and the stems bruised together are used for poulticing all sorts of tumours. In the district of Menabe the plant, associated with *Cynodon dactylon*, is applied to burns and sore eyes.

In Brazil a decoction of the herb or of the fruit is used as an injection in inveterate gonorrhœa.

In Northern Nigeria the leaves, along with natron and bran, are given to horses for internal troubles. Similarly in Sierra Leone the seeds are mixed with Guinea-corn and given to horses for worms, and constipation.

Agolo: Abali oicha—; *Aguku*: Abali ilenza—; *Akim*: Betekuo—; *Antsianaka*: Besofimbavy, Besofinantanana—; *Bakwiri*: Toli—; *Bengal*: Bunokra—; *Betsileo*: Besofina, Kihasinkasina—; *Bombay*: Nichardi—; *Brazil*: Carapicho, Carapicho da Calçada—; *Ceylon*: Aaiyooldi—; *English*: Paroqueet Burr—; *Ewe*: Bobui—; *Goa*: Tupsado—; *Gujerati*: Jhipato—; *Hansot*: Bharvado—; *Hausa*: 'Danka 'dafi, Suren fadama—; *Hindi*: Banokra, Chikti, Chiriyari—; *Hova*: Tsindailay, Tsitiamoty—; *Ibo*: Udo—; *Ijebu*: Epafo—; *La Reunion*: Hérisson blanc—; *Madagascar*: Besofina, Tsindailay—; *Marathi*: Jhinjhira, Jhinjudi, Kutrevandare, Nichardi—; *Matheran*: Necharda—; *Mauritius*: Herbe à panier, Hérisson blanc, Aadaye otti—; *Mende*: Chobwe, Chohobwe, Sogbe, Sogbei—; *Mundari*: Mindiat, Mindilata—; *Onitsha*: Udo mberi—; *Owerri*: Azuzo, Azu uzo, Oke udo, Udo mberi—; *Sakalave*: Kisalenjy, Tsirrijy—; *Sanskrit*: Jhinjharita, Jhinjhirita, Jhinjhurdi, Jhirpata, Kantaphali—; *Sinhalese*: Epala—; *Tamil*: Ottuppullu, Puramutti—; *Telugu*: Chirusitrika, Tutturubenda—; *Timne*: Agbint-marabana, Egbuntemoer, Ekboentemoer—; *Twi*: Petekuku—; *Umu Ahia*: Ngbo—; *Uriya*: Bojoromuli, Jotojoti—; *Wolof*: Doupereit—; *Yoruba*: Ako-bolobolo, Boko-pupa, Ilasa-omde—; *Zulu*: inDolaencane, iNorthwane—.

2. **Triumfetta semitriloba** Linn. is a tropical weed.

The leaves and fruit are mucilaginous and astringent.

The leaves are used in parts of Sierra Leone as a medicine for dysentery. In Cameroons a cold infusion of the leaves along with those of *Microdesmis puberula* is taken as a remedy for diarrhœa.

In Brazil a decoction of the herb or of the fruit is used as an injection in inveterate gonorrhœa.

Aguku: Agamevumawo—; *Ashanti*: Mfo—; *Bakwiri*: Toli—; *Brazil*: Carapicho, Carapicho da Calçada—; *Cameroons*: Okon, Okung—; *Duala*: Wonge—; *English*: Burweed—; *Ewe*: Bobui—; *Ibo*: Udo, Udo ji—; *Koranko*: Segbe—; *Limba*: Ubama-wuyeremi—; *Mende*: Bongewuli, Bonhui, Chobwe, Kpolohui, Kponhui, Pohui, Sogbe—; *Nzima*: Egurie—; *Onitsha*: Udo umuaka—; *Owerri*: Udo umuaka—; *Tagalog*: Calotang-bilok, Colotan—; *Timne*: E-boloni, Kaboloni, Ka-bononi, Raka—; *Visayan*: Daracot—; *Yoruba*: Esura—.

TIGER SHARK—*GALEOCERDO TIGRINUS* MULLER AND HENLE.

Feeding and Breeding Habits.

BY

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(*With three plates*).

An opportunity to amplify the existing morphological description and other characteristics of *Galeocerdo tigrinus* was afforded to the author during work on the extraction of oil from livers of sharks and rays. The tiger shark is fairly common off the Bombay, Ratnagiri and Kanara coasts. It is one of the terrors of coastal fishermen, who dread it on account of its extensive depredations and the severe havoc it causes to their nets, often entailing loss of their entire catch. Fishermen do not go in deliberate quest of the fish, as there is no shark industry in our Province. Whenever it is caught, it is accidental, being due solely to its being enmeshed in the nets. The fish feeds indiscriminately and voraciously on most of our edible fishes such as pomfrets, eels, ribbon fishes, etc. This fact has been amply borne out by an examination of its stomach contents. The shark is generally common from November to May and is taken at a depth of 6 to 10 fathoms while attacking nets with edible fish.

No systematic record of its life history is at hand and this deficiency, the author thought might partly be filled by a detailed information of its external characters, feeding and breeding habits, so that it may contribute to a fuller knowledge of an important member of the elasmobranchs which visits our coast.

Family	...	CARCHARHINIDAE.
Genus	...	Galeocerdo *Muller* and *Henle*.
Species	...	**Galeocerdo tigrinus** *Muller* and *Henle*.

Local names :—*Waghbeer* or *Waghsheer*.

(Plate 1. Fig. A.).

Description :—The genus Galeocerdo is characterised by the presence in both jaws of large, compressed and sub-triangular teeth, denticulated and externally notched. Each of the denticulations possesses serrations on its edges. The presence of such teeth, together with the presence of minute spiracles, labial folds and prominent subcaudal pits, singles out this genus from the remaining genera of the family Carcharhinidae. The shark is locally known as *Waghbeer* or *Waghsheer*, a name which describes the tiger-like

PLATE I

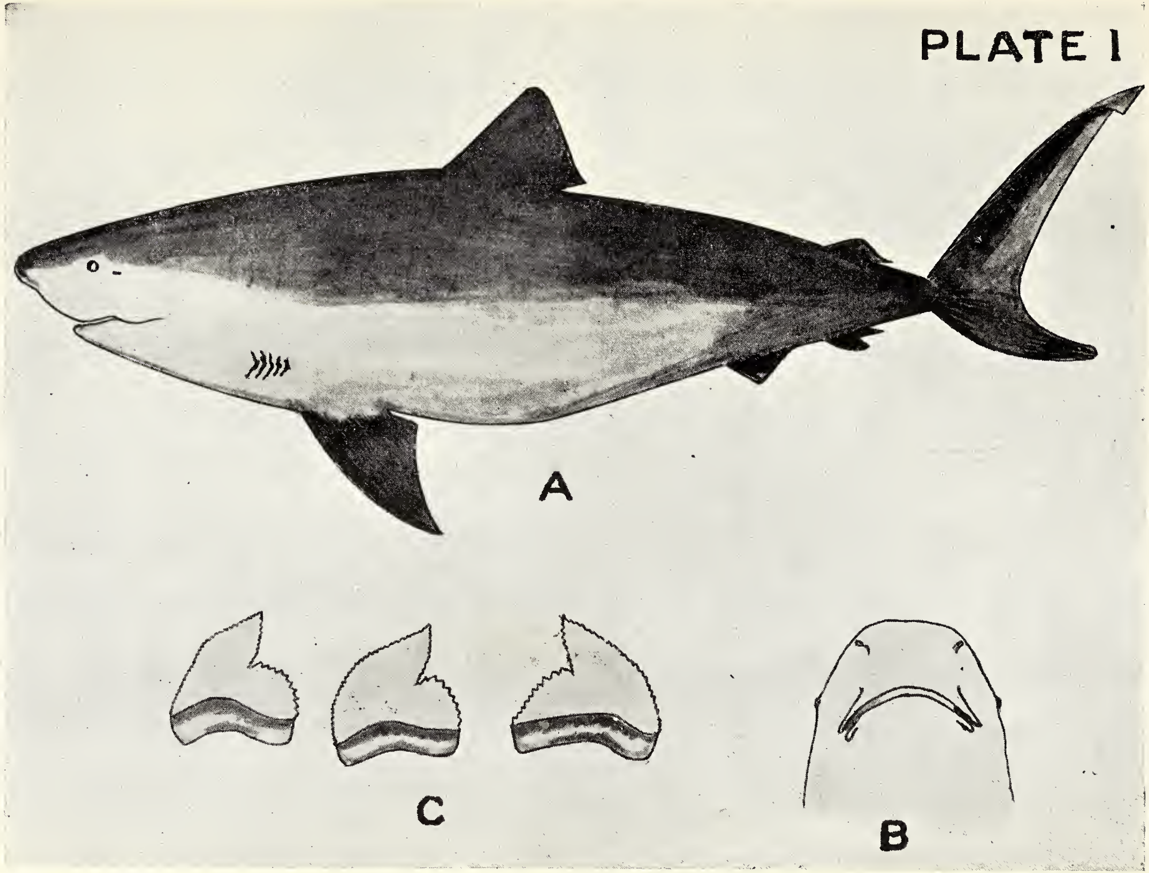


Plate 1:—Tiger shark, *Galeocerdo tigrinus*. A, female 13 ft. 1 in. long landed at Sassoon Dock, Bombay; B, undersurface of head; C, typical teeth of same.

markings on the individuals of this species in young stages. The snout is shovel-shaped, with a rounded outline. The length of its preoral portion is slightly less than half the width of the mouth and nearly 1/3rd that between the eye and the first gill opening. The width of the snout beyond the nostrils is less than the general width of the head. There are grooves at the angles of the mouth, which extend along both jaws for a considerable distance, that on the uppper jaw being nearly thrice as long as that on the lower (Plate 1. Fig. B). Nostrils, with distinct, triangular flap-like valves are situated on the borders of the snout, rather nearer its tip than the apex of the mouth. The eyes, of a moderate size, are oval in outline, with dark iris and rounded pupils. The spiracles are small and oval and are situated behind the eyes at a distance which is nearly twice the horizontal diameter of the orbit. Each gill slit is almost thrice the size of the eye.

Teeth: $\frac{21-24}{21-24}$. They are triangular in outline, with broad bases and with notches on their outer borders. The borders of the teeth are broadly serrated and each of the serrations has still finer serrations. The teeth on the upper jaw are slightly bigger than those on the lower (Plate 1. Fig. C).

Fins:—The pectorals are falciform in outline and extend to beneath the hind end of the base of the first dorsal fin. The outer edge of each is four times the inner. The first dorsal originates slightly behind the axil of the pectoral. The second dorsal originates very slightly in advance of the anal and is a little bigger than that fin. The caudal fin is nearly one-fourth the total length, with a well-developed subcaudal lobe. Two prominent keels run along the lateral borders of the trunk, beginning some distance behind the pelvic fins. Also, a prominent mid-dorsal crest starts behind the first dorsal and ends slightly ahead of the second dorsal.

Colour:—Bluish or yellowish grey above and white on the side and beneath, tinged with pink. The dorso-lateral surface in adults is marked by faint vertical bars or stripes. These markings fade with age and then the colour appears to be grey above and white underneath. Even then faint, dark, rounded spots may be discernible on the sides of the caudal blade. The newly born young, however, are pale grey, marked with dark, more or less vertical bars all over the dorsal surface and over the dorsal fins.

Size:—This shark attains a great size. Individuals measuring from 8 ft. to 13 ft. in length and weighing from 500 lb. to over a ton are frequently landed all along the western coast, from November to March.

Habitat:—Red sea, seas of India to Japan and beyond.

Feeding habits:—The shark is a nomad of the waters that surround our subcontinent—a fact which is evidenced in its wide geographical distribution. It feeds on smaller sharks, fishes like eels, pomfrets, black pomfrets, ribbon fishes, silver bar fishes, mullets, etc. and prawns and crabs. It also feeds on rotting carcases and other offal. Two sea snakes were taken from the stomach of a specimen landed at Ratnagiri, while a turtle (*Chelone* *mydas*), wholly intact, was found in the stomach of one caught in Bombay waters. The diversity of diet is well illustrated by an enumeration of the motley creatures found in a shark landed at Bombay on 17-1-1942. The shark which measured 13′ 1″, had a most amazing miscellany of food recently swallowed, consisting of

Five white pomfrets	...	*Stromateus cinereus*
One black pomfret	...	*Stromateus niger*
Karli	...	*Chirocentrus dorab*
Palla	...	*Clupea ilisha*
73 Ribbon fishes	...	*Trichiurus savala*
Koth	...	*Sciaenoides brunneus*
Mandeli	...	*Coilia dussumieri*

and a large quantity of prawns, crabs, squids etc.

The pomfrets secured from the shark's stomach were completely whole and wholesome, so much so that the fishermen washed them and sold them to the local dealers. Their appearance was such that none would have hazarded the view that they had been recovered from a shark's stomach. (Plate 3. Fig. A). Swallowing of fish complete and untorn by such sharks is also commented on by G. P. Whitley, who writes as follows—

> 'It would seem that the tiger shark is not a fierce or voracious man-eater, but a quiet scavenger which approaches its food and swallows it without tearing it in pieces, but it is perhaps not safe to judge too far from habits in captivity.'

The list of fish taken from its stomach clearly indicates the enormous havoc wrought by this shark with consequent loss to our fishermen. Unfortunately, the intensity of this menace cannot be abated in our Presidency in view of the total absence of a shark fishing industry, which would automatically have the effect of reducing the depredations of these monsters and minimising loss to the fishermen. Local fishermen catch sharks only incidentally while fishing for other varieties of fish for the market.

Describing its mode of feeding, Dr. Jerdon, a keen observer of Indian fishes, notes that:—

> 'this shark swells itself out so as to look like a floating mass of animal substance and having thus decoyed its prey, it immediately attacks it.

Our fishermen, too, have observed this shark swelling out into a sort of floating mass but have been unable to explain its significance. To this extent, Jerdon's observation appears to be correct.

The tiger shark is known to attack man, and recently there was a report from Malwan, on the Ratnagiri coast, of a man being attacked and killed by one. The fishermen recognised the assailant as 'waghbeer'. This shark also works havoc among fishermen's nets which are often carried away by it.

Economics:—The shark is fairly important from an economic point of view. Its liver yields a high percentage of oil of fairly good vitamin A content, having a vitamin potency from two to three thousand Blue units per gramme. The maximum weight of liver recorded was 150 lb., which yielded 10 gallons of oil. The livers of adult sharks are not eaten, but those of newly born young

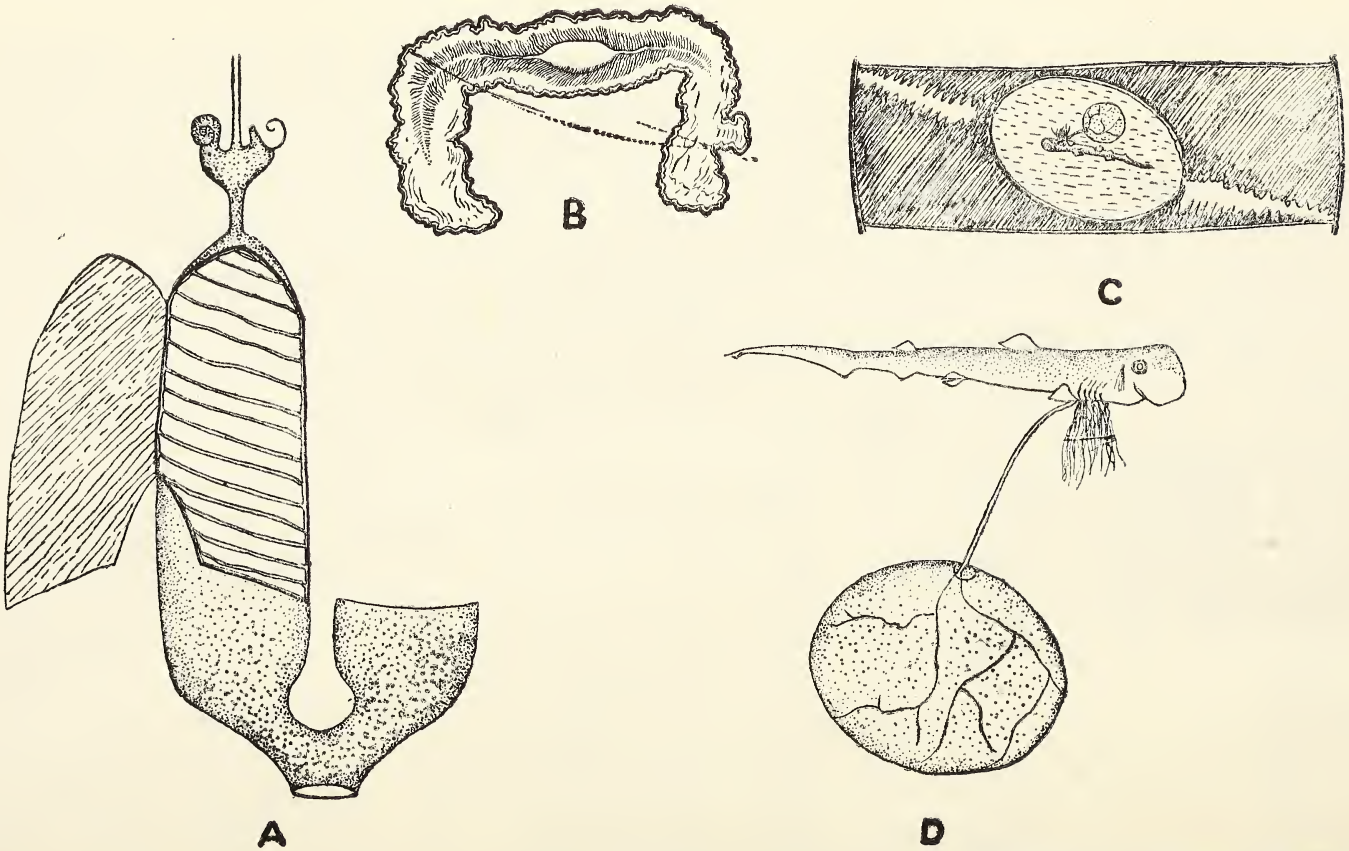


Plate 2 :—A, uterus partly opened to show arrangement of compartments; B, spindle-shaped, unfertilized egg within shell membrane; C, compartment showing embryo within the water-filled sac in the shell membrane; D, embryo 6.8 cms. long with its umbilical cord and large yolk-sac. Note filaments in gill slits and spiracles.

ones are considered a delicacy by fisherfolk. The flesh is salted and consumed in inland districts and is considered exceedingly nourishing. The fins of this shark are not of much value.

Breeding habits (early stage)

Large females from 10 ft. to 13 ft. long and bearing from 26 to 44 young ones are frequently landed in Bombay. A female measuring 12 ft. in length and weighing about 800 lb. was landed at Sassoon Dock on December 15, 1941. Examination of the fish revealed that it was pregnant, both uteri being well developed, elongated structures, occupying nearly the whole of the abdominal cavity. Both ovaries were present, but did not contain prominent eggs. The oviducts were short and the nidamental glands, which were situated nearer the uteri, consisted of two coiled horns each, one of the horns being directed posteriorly and the other anteriorly. The uteri were long bag-like structures, not very broad and had thin vascular walls. They opened by a common aperture into the cloaca.

Structure of uterus and disposition of embryos.

(Plate 2. Fig. A).

The outermost epithelial coat of the uterus and the fibro-serous coat next to it can easily be separated from the highly vascular spongy coat, which contains greatly relaxed circular muscular fibres. The uterine wall being carefully cut through, each uterus is seen to be divided by transverse partitions into about 22 transverse compartments. The mucous membrane lining the compartments is very highly vascular. The embryo in each compartment is placed rather obliquely, enclosed in a thin and rounded sac formed within an elastic, yellow, iridiscent shell-membrane and filled with a watery liquid in which it floats freely. In front of and behind this sac, there are two brownish yellow, wrinkled tufts, formed by great folding and plaiting of the shell membrane.

Only 18 out of the 22 compartments of the above-mentioned female contained developing embryos, while four contained unfertilised, spindle-shaped eggs enclosed in thin pouches of the shell-membranes. Both the embryos and the unfertilised eggs, together with their shell-membranes, were closely examined in the laboratory.

Shell membranes and unfertilised eggs.

(Plate 2. Fig. B).

Eggs that escape fertilisation receive the same treatment from the nidamental glands as fertilised eggs. These are spindle-shaped, transparent, gelatinous structures enclosed in shell membranes and lie obliquely in compartments in the same manner as the embryos. Tufts of the shell membrane are present, and on these being stretched out, the membrane extends into a thin, long quadrangular sheet, in the centre of which a spindle-shaped sac is seen to be present. This has thin, transparent walls derived from the laminae of the membrane. When the upper wall of the sac is carefully removed, a transparent, gelatinous, albuminous substance is seen surrounding a small quantity of pale yellow yolk in the sac. This substance and a little of the yolk also extend into the ends of the spindle. There is, however, no watery liquid in these sacs as in the sacs containing embryos. It is possible that the watery liquid in the sacs containing embryos originates from this gelatinous albuminous substance.

Shell membranes and embryos.

(Plate 2. Fig. C).

The wrinkled and plaited tufts of the shell membrane enclosing the embryo are stretched out and the membrane spreads out into a long, thin, elastic, hyaline and transparent quadrangular sheet, in the centre of which there is a thin-walled sac filled with a watery liquid. In this, the tiny embryo, with its umbilical cord and yolk-sac, floats freely. The upper wall of this central sac is seen to be formed by a very thin lamina rising from the centre of the shell-membrane.

EMBRYOS.

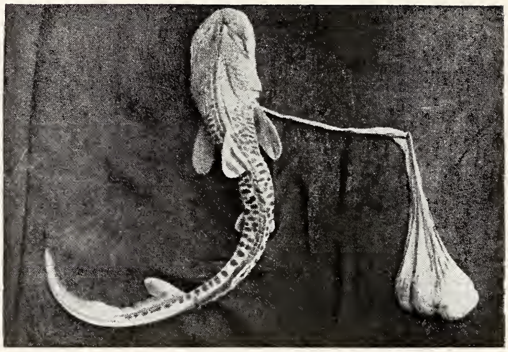
(Plate 2. Fig. D).

Dimensions:—

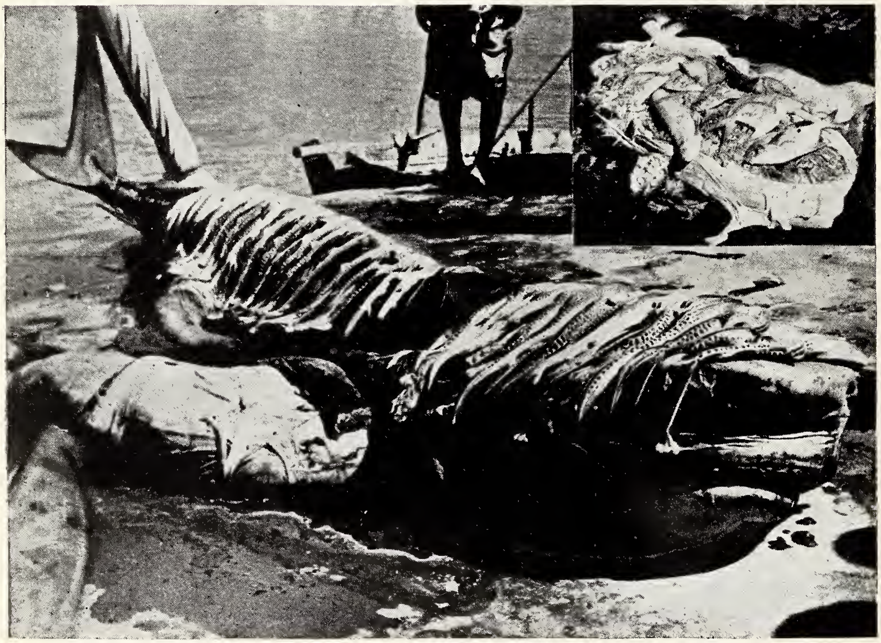
(*a*) Total length of embryo—6.8 to 7.5 cms.
(*b*) Length of the caudal fin—1.8 cms.
(*c*) Length of longest branchial filament—2.5 cms.
(*d*) Length of umbilical cord—4.3 cms.
(*e*) Diameter of yolk-sac—5.6 cms.
(*f*) Length of filament in spiracle—1.1 cms.

The embryos are semi-transparent, pale white or ivory, partly suffused with crimson, and have loose membranes hanging in the region of the fins. The myotomes can be seen through the transparent skin covering them. All the external features seen in the adult are developed, but are in a rudimentary condition. The head region is rounded and swollen dorsally, and the divisions of the brain can be seen through. The region of the snout in front of the mouth and below the swollen brain region is rounded in outline, its length being nearly equal to the width of the mouth at this stage. Large prominent eyes, with sparsely pigmented iris, are situated on the lateral margins of the head. Some distance behind the eyes are situated tiny spiracles, rounded in outline as contrasted with the oval spiracles of the adult form. Through each spiracle issues a bunch of crowded filaments similar to the branchial filaments. The presence of such filaments in the spiracles of early embryos suggests the possibility that they, too, may be serving the same function as the branchial filaments, viz. of absorbing the liquid in the sac, which is probably nutritive in nature.

A bunch of crowded, crimson-coloured branchial filaments issues from each gill slit. Rudiments of all the fins are present, these being mere membranes, only partially covering the fin rays. The pectorals arise behind the last gill slit. The first dorsal fin is situated midway between the pectorals and the pelvics. The second dorsal and the anal fins are opposite each other. The sub-caudal lobe is not well developed. The umbilical cord pierces the abdominal wall between the pectoral fins.



A



B

Plate 3 :—A, embryo with yolk-sac and umbilical cord (advanced stage). Note conspicuous tiger-like markings; B, 42 embryos each weighing 1 lb. are seen spread out along the mother's body. The white bag on the left is the shark's stomach from which were taken several basketsfull of miscellaneous and quite fresh fish (Inset top right).

Yolk-sac:—This is a massive rounded bag, filled with heavy yellow yolk, and its walls have well developed blood capillaries which continuously unite to form larger vessels. A transparent, gelatinous disc is present at the upper pole of the yolk-sac. A single prominent vein courses vertically up along the yolk-sac wall towards the disc, and two horizontally placed arteries unite to form a single artery, so that it and the single vein eventually emerge from the disc to pass into the umbilical cord. Between these two vessels can be discerned passing upwards a very minute prolongation of the sac, and this represents the yolk-duct. The yolk-sac is enclosed in a very thin envelope of connective tissue which is continued over the umbilical cord.

Umbilical cord:—This structure originates at the upper pole of the yolk-sac and terminates by piercing the abdominal wall of the embryo between the pectoral fins. The cord consists of the umbilical artery, the umbilical vein and the yolk-duct between the two. The vein and the artery are formed by the union of the venous and arterial capillaries respectively, ramified in the mesoblastic tissue of the yolk-sac wall, while the yolk-duct is a mere prolongation of the sac conducting yolk granules. All these three structures are enclosed in a gelatinous, tubular sheath, which, in turn, is covered over by a prolongation of the connective tissue covering the yolk-sac. There are no appendicula on the umbilical cord. The exact arrangement of the umbilical vessels in the body of the embryo cannot be made out, but the yolk-duct is seen to give rise to an internal yolk-sac which joins the upper end of the colon on its dorsal aspect.

BREEDING HABITS. (Advanced stage).
(Plate 3. Fig. A).

An outsize female, weighing over a ton, was landed at Sassoon Dock on January 17, 1942. It contained a liver weighing approximately 150 lb. The monster was captured as it was attacking the bag end of a 'dol' net in which a great quantity of fish had been trapped. The shark was dead by the time it was landed. Its dimensions were as follows:—

(1) Total length from tip of snout to tip of tail	... 13 ft. .1 in.
(2) Length of caudal fin	... 3 ft. .2 in.
(3) Girth round widest part of body	... 6 ft. .8 in.
(4) Width at angles of the mouth	... 21 in.
(5) Length of preoral portion of snout	... 6 in.
(6) Distance between the eye and spiracle	... 2.75 in.
(7) Distance between the eye and the first gill opening	... 16.5 in.

Both the uteri in this female were distended structures occupying the entire length of the abdominal cavity. The ovaries were rather small and did not contain ripe ova. The oviducts were short.

The wall of each uterus is rather thin. The spongy coat is highly vascular and the circular muscle coat not very prominent. On carefully cutting through these, the transversely placed uterine compartments come into view. The mucous membrane in each compartment is almost purplish crimson in hue, being highly vascular. Each compartment contains a large water-filled sac enclosing the embryo with its attached structures, viz., the umbilical cord and the yolk-sac. These water-sacs, which are formed within the shell-membranes, now assume such proportions as completely to obliterate the proximal and distal plaits and folds of the shell membrane present in the early stages of the embryonic development. A slight tilting of these sacs causes the embryos, with their attached structures, to move freely in the liquid, thus showing that the yolk-sacs do not enter into any connection with the maternal tissue.

Each uterus of the aforesaid female contained 21 well developed embryos, but only one embryo out of the 42 was under developed and had undergone degenerative changes. Of the remaining 41 embryos, 30 were female and 11 male.

EMBRYOS.

(Plate 3. Fig. B).

	Dimensions		*Male*		*Female*
1.	Total length ...	...	20·5″	...	19″
2.	Length of the caudal fin	...	7·5″	...	7·25″
3.	Length of the umbilical cord.		5·5″	...	5·25″
4.	Diameter of the yolk-sac.	...	3·75″	...	4·75″

The embryos at this stage are almost fully developed, but differ from the parent fish in having a totally different dorsal colouration and possessing the umbilical cords and yolk-sacs. The embryos possess the following morphological characters.

The snout is semicircular in outline, its preoral portion being slightly more than half the width of the mouth. The nostrils, with triangular valves, are situated midway between the tip of the snout and the apex of the mouth. The groove along the upper jaw is thrice as long as that on the lower, and extends below the anterior margin of the orbit. The spiracles are situated behind the orbits at a distance of about one-third the orbital diameter. The gill slits are without branchial filaments. The pectoral fin originates below a point slightly in front of the fourth gill slit. The first dorsal originates behind the posterior end of the base of the pectoral, and its hind tip does not reach the origin of the pelvic. The second dorsal originates slightly in advance of the anal. The bases of both these fins are nearly equal. The anal is situated midway between the posterior end of the base of the pelvic and the root of the caudal. The caudal fin is about one-third the total length of the embryo.

Originating behind the skull and extending backwards on either side of the mid-dorsal line are two keels which assume a lateral position, a short distance ahead of the second dorsal, and continue behind as the lateral keels. In the region of the caudal fin, they turn upwards and continue on either side of the caudal blade. A narrow groove extends from behind the base of the first dorsal and stops short in front of the origin of the second dorsal. The scales are sparingly set all over the body.

Colouration:—The head is grey. Roundish or oval black spots are visible behind the skull. The dorsal surface of the body is marked by black stripes or curved bars. There are dark transverse bars on the first dorsal, and the top of the second dorsal is black. Below and behind the second dorsal are darkish oval spots, above the lateral keels, and these spots become rounded on either side of the caudal blade. The upper margin of the caudal fin is light in colour, but the lower is darker. The ventral surface is ivory, as are also the pelvic and anal fins, although their tips show a very faint grey pigmentation.

The Yolk-sac:—The yolk-sacs, are fairly big and contain a considerable quantity of yellow, granular yolk in the lower parts. Their walls are highly vascular, and the superficial blood capillaries in some of the yolk-sacs run parallel to one another, coursing vertically upwards. The capillaries ultimately join to form the umbilical vessels. At the upper pole of the yolk-sac there is a slight bulge, marking the beginning of the umbilical cord. The large size of the yolk-sacs with plenty of yolk yet left in them, the absence of any trace of foldings on their walls distally and their free positions in the water-filled sacs containing the embryos, point to the possibility that a yolk-sac placenta is not at all formed in this species, and that nutrition is supplied to the developing embryo in the form of yolk throughout its intra-uterine life.

Umbilical cord:—It consists of the vitelline duct, the umbilical artery and the umbilical vein, enclosed in a smooth tubular sheath of connective tissue reflcted from the outer layers of the yolk-sac walls. On carefully opening this sheath, it is seen to contain a certain amount of a dark-brown or reddish serumlike liquid in contact with the vessels. This liquid is also found in the bulge at the top of the yolk-sac. It is probable that the yolk is converted into this liquid, which is finally absorbed by the umbilical vein and carried into the hepatic portal system of the embryo.

The vitelline duct is seen to open into a fairly big internal yolk-sac lying on the dorsal side of the colon and opening into it dorsally, at its upper pole. The size of the internal yolk-sac is found to vary inversely with that of the external yolk-sac, being larger when the yolk in the external yolk-sac is small in quantity and vice versa. The umbilical vessels are traced into the body of the embryo, and the vein is seen to join the hepatic portal vein before the latter bifurcates to enter the hepatic lobes, while the umbilical artery is seen to course along the posterior wall of the upper end of the internal yolk-sac to become the continuation of a branch of the coeliaco-mesenteric artery, the other branch of which supplies blood to the posterior wall of the small intestine.

Comparison of the two embryonic stages of *Galeocerdo tigrinus* reveals the following noteworthy points:—

(1) In both stages of development, the embryos are enclosed in water-filled sacs formed in the shell membranes.

(2) The very small size of the embryo in the early stage necessitates great plaiting and folding of the shell-membrane both proximally and distally, whereas in the later stages the well-grown

embryo requires the covering of the entire shell-membrane, so that the proximal and distal foldings disappear.

(3) The branchial filaments are present in the earlier stages and their function appears to be to absorb the liquid in the sac, which is probably nutritive in value. The same function may be assigned to the filaments in the spiracles. In the later stages the branchial filaments as also the filaments in the spiracles are no longer present and the function of nutrition is carried out by other well developed structures, namely, yolk duct and the umbilical vessels.

(4) The embryos in the early stages are of a pale ivory colour, no pigmentation being present. In the later stages, however, pigmentation is perfect and the dorsal colouration of the embryo is characteristically tiger-like.

(5) No trace of a serum-like liquid is noticeable when the umbilical cord is slit open in the earlier stages, whereas a reddish serum-like liquid can be seen lying in contact with the umbilical vessels when the sheath of the cord is opened in the later stages.

INFERENCES.

(1) The embryos of *Galeocerdo tigrinus* grow to a large size (nearly 2.5 ft. in length) before birth. At birth they have conspicuous tiger-like markings on their bodies.

(2) Extra protection seems to be afforded to the developing embryos by their envelopment in sacs filled with a watery liquid. The liquid must probably also be having a nutritive function in the earlier stages, at least, of the embryonic development.

(3) The large quantity of yolk in the yolk-sac appears to nourish the embryo throughout its intra-uterine life. Further, the absence of any folding of the yolk-sac wall even in the advanced stages of development and the free position of the embryo in the uterine compartment seem to suggest that a yolk-sac placenta may not at all form in the tiger shark.

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A REVIEW

REPORT OF THE GAME AND GAME FISHES PRESERVATION COMMITTEE ON THE EXISTING SPECIES OF GAME IN BENGAL. Compiled by L. R. Fawcus, Esq., C.I.E., I.C.S., Pages i-iv+i-ii+1-53, Superintendent, Government Printing, Bengal, Government Press, Alipore, Bengal, 1943. Price—Indian, Rs. 3; English, 5*s*. 3*d*.

The members of the Society and lovers of sport all over the world will be greatly interested to learn of the publication of the Report under review. The gradual decline of game in the Bengal 'shikar' areas, the likely chances of its reaching the vanishing point, and the concern felt by the Bengal Government in this matter, led to the appointment of the above mentioned Committee with the hope of finding means to arrest this decline for the benefit of future naturalists and sportsmen. At the outset, the Committee felt that it will be profitable 'to take stock, so far as we can, of the game which still remains in Bengal and though no exact census is obviously possible, this Committee has done its best to gather from those[1] best able to give it, as accurate information as possible on the existing distribution in Bengal of the animals, birds and fish which are conventionally known as game'. In the absence of precise definition of game animals, treatment of certain species, which the sportsman may not call game but which those with love for natural history would look on with interest, has also been included. No attempt has been made to compile a catalogue of names or give technical descriptions of species, but, section by section, some account is given of the game found in Bengal today, together with information of their numbers, habitat and distribution. The Committee has generally avoided to give exact specification of localities so as to save destruction of game by pot-hunters in Bengal.

The first section of the Report deals with animals (mammals) such as Greater and Lesser Cats; Civets and their relatives; Mongooses; Hyaena; Dog Family; Weasels, Otters and Bears; Rodents; Wild Elephant in Bengal; Rhinoceros in Bengal; Bison and Buffalo; Serow and Goral; Antelopes and Deer; Pigs; and Pangolins.

A treatment of Birds is given in the 2nd section and such forms are dealt with as Pigeons and Doves; Sand Grouse; Peacocks and Pheasants; True Quails and Partridges; Button Quails; Rails, Cranes, Bustards and Floricans; Plovers, Snipe and Woodcock; Ortolans; Ducks and Geese of Bengal; and Semi-Sporting Birds.

In the 3rd section larger Reptiles, such as Crocodiles, Python and Monitor Lizards, are dealt with, while the final section, dealing with the Game Fishes of Bengal, contains an account of the three Himalayan species of Mahseer, Katli, Indian Trout and Goonch. A key to the three species of Mahseer is given and their main distinguishing features are explained with the help of illustrations.

The Report under review shows clear evidence of having been based on extensive material, which has been carefully sifted and ably edited. The thanks of sportsmen and naturalists are due to the Committee and especially to Mr. L. R. Fawcus, who compiled the Report, for the production of such a useful and interesting work.

The volume is nicely bound in the usual style of Government publications. The printing and general get-up do considerable credit to the authorities of the Bengal Government Press. A few typographical mistakes have been noted but they were perhaps unavoidable in a compilation of this nature.

S. L. H.

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[1] Sub-Section of the Report dealing with 'Elephants and Rhinoceros' was contributed by Mr. T. V. Dent, I.F.S., that on 'Ducks and Geese of Bengal' by Mr. W. A. S. Lewis, I.C.S., and the one on 'The Game Fishes of Bengal' by Sunder Lal Hora, Director of Fisheries, Bengal.

OBITUARY

We regret to announce the death in England of Mr. Hugh Whistler, the well-known ornithologist—author of *A Popular Handbook of Indian Birds*—early in July, 1943. A fuller obituary notice will appear in a later issue.

MISCELLANEOUS NOTES

I.—THE RECORD SKULL OF AN INDIAN CLOUDED LEOPARD (*NEOFELIS NEBULOSA* GRIFFITH).

Although in Rowland Ward's Records for 1935 skin-measurements of the Clouded Leopard are entered, no mention is made of the skulls presumably because they were considered to be of no interest to Indian sportsmen. Since some of the readers of the *Journal* may be interested in the subject, I give the conventional dimensions of the skull of an adult ♂ from Assam which appears to be a little longer than any skull of which the measurements have hitherto been published. It was figured by Gray in 1867, by Blanford in his Mammals of British India, p. 73 and by myself in vol. i of my edition of this work, p. 247, 1939. The skull itself, however, was not available to me when I drew up the table of measurements (p. 252). In that table the largest specimen entered was an adult ♂ from Nepal which is appreciably shorter. But in the Appendix to vol. ii of the same work, 1941, p. 475, I gave the dimensions of an adult ♂ from Sumatra which exceeded the Nepal skull.

In the following table the length and breadth of 4 skulls are entered in English inches and in millimetres, the latter being in brackets:—

Locality	*Total length*	*Zygomatic width*
Assam (Zool. Soc.) ad. ♂ ...	$7\frac{3}{4}$ (192)	$4\frac{3}{4}$ (121)
Nepal (Hodgson) ad. ♂ ...	$7\frac{1}{10}$ (180)	$4\frac{3}{4}$ (121)
Tista, Sikkim (Frost) just ad. ♂ ...	$6\frac{1}{2}$ (167)	4 (102)
Sumatra (Frost) ad. ♂ ...	$7\frac{1}{2}$ (190)	$4\frac{9}{10}$ (125)

It may be noted that the two largest skulls are longer than the ♂ skull of a Snow Leopard entered on p. 242 of my vol. i and longer than several ♀ skulls of Panthers entered on p. 230.

BRITISH MUSEUM (NAT. HIST.), R. I. POCOCK.
LONDON, S. W. 7.
September 11, 1942.

II.—ELEPHANT AND BISON ON ROAD WAYS.

Two incidents recently occurred on the Ghat Road leading down from the Billigirirangan Hills. The first in connection with elephants and a cart-bull, and the second a solitary bull bison—obviously sick—and a motor car.

(1) A single cart-bull had been trotting in front of a car travelling from the Estate down the Ghat for some way, and eventually the

car was stopped and H., a visitor to Honnametti, got out and ran after the bull in the hopes of turning it off the road. On rounding the corner an extraordinary sight met his eyes:—An elephant group—a bull and 2 cows and a calf, had just come on to the road, and as the cart-bull trotted up to the party the 2 cows put their heads together and without hesitation pushed the cart-bull off the road down into the long grass below. Luckily it was not much of a drop and the cart-bull appeared to suffer no harm!

(2) While motoring up the road to Honnametti my wife came on a solitary bull bison walking slowly up the road in the same direction. The bison appeared to take no notice of the car behind it but heaved from side to side as though very ill. On my wife sounding the horn, however, the bull turned round, lowered its head and advanced slowly towards the car. The car was reversed none too steadily however and went into the bank! The bull had in the meantime turned again and proceeded to walk up the road once more. It turned and repeated the performance every time the horn was sounded. Eventually the bull turned the corner and my wife gave it about 10 minutes before following slowly in the car, only to find the bull waiting expectantly round the corner facing her with its head down. Reversing back round the corner, my wife waited for about 20 minutes before proceeding slowly forward again by which time the bull had left the road and could be observed moving slowly through the long grass below, every now and again staggering from side to side and giving every indication of suffering from either a severe wound or disease. One may assume that sick as it was, the bull would have attacked the car, had my wife not reversed on each occasion; and had those in the car not realized that the bull was definitely not in its normal condition, the incident might have given rise to a record of another instance of an unprovoked attack by an unwounded bull bison.

C/O BASE POST OFFICE,
CEYLON.
March 23, 1943.

R. C. MORRIS,
Lt.-Col.

III.—OCCURRENCE OF THE HIMALAYAN TAHR (*HEMITRAGUS JEMLAHICUS*) IN SIKKIM.

As little appears to be known about the distribution of the Himalayan Tahr (*Hemitragus jemlahicus*) in the eastern part of its range, the following note may be of interest.

Unfortunately I lost my shikar diary during the withdrawal from Libya last year and this note is written from memory only, so the details as to elevations, distances, etc. may be slightly erroneous, but the main facts are correct.

In November 1939, while waiting to join up, I decided to fill in time with a shooting trip in Sikkim as I was already living in the Darjeeling district, the original object being simply to bag a Burhel (*Pseudöis nahoor*).

While discussing passes etc. with the political officer at Gangtok, I was told that earlier in the year a German Natural History Expedition, from I think, Munich, had discovered 'a new kind of animal on the slopes of Kancheng-junga'. This animal was described as a sort of goat or sheep and went by the local (Lepcha) name of '*shepi*'. There was no mention of it in the Sikkim Durbar's list of game which may or may not be shot, and I could find out nothing more about it in Gangtok.

It did not at that time occur to me that it might be a type of Tahr, as the Tahr was not included in the above mentioned list either, and although I believe the Tahr is known to occur as far East as Bhutan, I had only heard of one case of its being reported from Sikkim which was many years ago somewhere in the Talung Chu. In any case a German Natural History Expedition would presumably have recognised a Tahr on seeing one, and would hardly have described it as 'a new kind of animal', though it must be admitted I only had this information at second hand.

The omission of the Tahr from the Sikkim game list may be due to confusion arising from the fact that in Sikkim and the Darjeeling district the local (Paharia) name for Serow (*Capricornis sumatrensis*) is '*tahr*' and the Serow is included in the list.

I had more or less forgotten about the '*shepi*' until I got to Chum Tang, a Lepcha village near where the Lachen and Lachung rivers join to form the Teesta; here I found one of the local Lepchas had joined the German expedition earlier in the year, and on enquiry he said he knew of the place where they had found the '*shepi*', though he had not been with them at the time. It was many years since he had seen a live specimen himself.

My time and stores being limited, I pushed on to Thanga after Burhel but made arrangements for the Lepcha 'shikari' to go to the '*shepi*' ground straightaway and to report to me on my return journey as to the chances of finding any.

On my getting back to Chum Tang about a fortnight later, the shikari met me and told me that after spending several days and nights in the jungle, he had located a flock of '*shepi*'. The ground was apparently situated some distance up a small tributary, the Pim Chu, which joins the Lachen on its right bank about five miles above Chum Tang.

The next morning we set off for the '*shepi*' ground, travelling light; the shikari, two coolies and myself. The distance from Chum Tang turned out to be only about ten miles but the going was very bad. A cattle path led along the bank of the Lachen for two or three miles, but after that there was no track at all and kukris had to be used frequently to cut a path through the jungle to allow the laden coolies to follow. In many places ladders had to be made out of tree-trunks to help them to climb up steep banks and rock-faces and over some of the enormous boulders which completely blocked the bed of the stream.

The range at the head of the Pim Chu is some 12,000 to 14,000 ft. in height and the valley floor slopes very rapidly towards the Lachen, with numerous water-falls in its course. The hills on either side are extremely steep and clothed in dense forest, but where the bed of the stream reaches about 7,500 ft., the forest stops abruptly and above this the banks on either side are positively precipitous, while above the precipices there are steep grassy slopes dotted with patches of scrub-jungle and stunted bamboos. The whole area is cut up and broken by old land-slips and the surface is mostly very loose and gives but poor foot-hold. The rain fall during the monsoon must be fairly heavy, and at the time of year that I was there (early December) the sun never penetrates to the valley floor, leaving it cold and inhospitable.

By about 3 p.m. we had almost reached the point where the jungle ends and the precipices begin, and as there is no flat ground or water available except in the bed of the stream, we decided to camp there on a patch of sand between the boulders, in spite of the obvious chilliness of the place. There was no alternative anyway !

The Lepchas proceeded to build themselves a lean-to out of branches and leaves, backed by a large rock, and I had a forty-pound wind-proof tent. While putting up the latter the shikari suddenly said, 'There they are !' and pointed towards the grassy slopes further up the opposite (North) side of the valley. I could hardly believe him, as I was under the impression that we should have to go considerably higher before finding any '*shepi*', but on examining the slope through my binoculars, I could certainly make out two or three black animals grazing at the top of one of the cliffs. I was still somewhat sceptical however and thought they were probably only Serow after all, as we had noticed plenty of Serow tracks in the jungle on the way up from Chum Tang, but the Shikari swore that they were not Serow ('*Tahr*' in his language), but '*shepi*'.

It was too late to begin a stalk that evening and the same night I had the misfortune to develop an attack of dysentery.

The next morning we could see no '*shepi*' from the camp, so we climbed up through the jungle on the north side of the Pim Chu, and by about mid-day, reached the top of a rock slab overhanging the slopes on which the '*shepi*' had been grazing the previous evening; the only living thing to be seen however, was a cock monal pheasant (*L. refulgens*), and except for some tracks and droppings in the jungle, which might easily have been those of Serow, there was no sign of the '*shepi*'. We had something to eat and were resting on the top of the cliffs, high above the floor of the valley, when three or four black objects appeared, but this time on the south side of the nullah, i.e., the side opposite to us, and well out of rifle-range. It was impossible to cross the valley at that point as the precipices on either side were quite unclimbable; the only way was to return to the camp-site some distance back down the valley and to cross there. There was not time to do this before dark, so we just had to content ourselves with waiting in the hope that something might turn up on the slope below our rock where we had seen them the evening before. Nothing appeared however, but I had a good view through my binoculars of the '*shepi*' grazing on the opposite cliffs, and I watched them for a considerable time.

The following day we tried the cliffs on the south side and nearly got within range of a male with the best head I had so far seen, but the going was extremely bad and I was beginning to feel weak with dysentery; the result was that I dislodged a stone which went bounding down the hill side and scared the '*shepi*' who went off, with a shrill whistle of alarm, straight up the valley where the ground rapidly got worse, and we soon had to give up any attempt to follow them.

We were making our way back to camp in the late afternoon when five '*shepi*' appeared on the far side of the nullah below the slope on which we had first seen them, but of course they were again out of range; I had another good view however.

We tried the north side once more the next day, but by then I was feeling decidedly groggy and could not move without sending showers of stones down the hill sides, and again the only '*shepi*' we saw were on the opposite side of the valley.

The following day I was feeling slightly better, but provisions were running low, and as I still had a four-day treck back even to the comparative civilisation of Gangtok, and considering the state of my health, I thought it advisable to move back to Cham Tang, as I saw no more of the '*shepi*'.

During my four days in the Pim Chu valley however, I had several good views of '*shepi*' through field-glasses, and on one occasion without glasses, and I am convinced they are the same as the '*Tahr*' of the Western Himalayas, or possibly an eastern race of the same species. The Lepcha shikari said they were the same kind of animals as the German Expedition had obtained. I personally saw at least eight '*shepi*' and there may have been dozen or more inhabiting that part of the valley, but curiously enough, a friend of mine who visited the same spot with the same shikari some two months later, was unable to find any at all; the snow conditions would of course have changed by then; when I was there the snow was not lying below 10,000 ft., though it froze hard every night.

ON ACTIVE SERVICE, C. J. T. WRENICKE,
April 1943. *Capt.*

IV.—LIFE SPAN OF SOME WILD ANIMALS IN CAPTIVITY.

A Chital stag (*Axis axis* Erxl) born in the Trivandrum Zoo in 1920, died of old age last December. For some time previous to its death it was showing unmistakable signs of old age. Veterinary examination also resulted in establishing old age as the cause of death. This deer has thus lived for 22 years. We have had others of the same species for periods ranging from 12 to 18 years. Would it be a record age for Chital in captivity, as it is so for this zoo?

Incidentally, similar records of the age of some other animals may not be out of place. In spite of the curtailment of freedom involved in keeping wild animals in captivity, it has been the experience of the staff of menageries and Zoological Parks, that most of the animals and birds live to a ripe old age. As we have no means to ascertain the span of life of animals in their wild state, it would only be possible to infer the years for which they would live, from the data available in zoos. Therefore, a few particulars regarding the age of some of the animals kept here are added for what they are worth.

Mammals.—Among Primates, an Orangoutan (*Simia satyrus*) survived for 15 years and a Black Ape (*Cynopithecus niger*) lived for 21 years. A Baboon monkey (*Papio hamadryas*) acquired as an adult, died after 22 years of captivity, while a Bonnet monkey (*Macacus sinicus*) died after 23 years.

There have been some long lived ones among the carnivora too. A lion, born here in 1919 died last year at the age of 23. Another, born in 1923 is still going strong. The recorded maximum age for tigers and panthers is 16.

We have not been able to ascertain the maximum age of the Himalayan Bear. One of this species, aged 10 at the time of acquisition has been here for the last 12 years.

An important loss which this zoo had to sustain a few months back was due to the death of a bull Giraffe (*G. camelopardalis*) imported from Africa in 1927. It was a full-grown one then probably 8 years old, and has lived here till September 1942 (15 years). Among other mammals, special mention may be made of a Porcupine (*Hystrix leucura*) and an Otter (*Lutra vulgaris*) both of which have completed 22 years of captivity. The former died in 1942 while the latter is still living.

Birds. A recent newspaper report mentioned a 150 years old Cockatoo of the London Zoo as one of the casualties during an air raid alert. We have had parrots living only for 33 years, not even attaining the half century. Eagles and vultures have lived for 40 years. An Australian Cassowary hatched out here 37 years ago is still living. Similarly a Hornbill (*Dichoceros bicornis*) purchased for the zoo in 1905 (37 years) and an Adjutant crane (*Leptoptilus dubius*) obtained in 1911 (31 years) are alive. A little Cormorant (*Phalacrocorax niger*) died only last week after a period of 21 years of captivity. A curious feature about this bird was that for a long time before its death it had lost the use of both of its eyes and had to be fed by its keeper. There is another cormorant of the same age. One of its eyes is blind, but it is still alive.

GOVT. ZOOLOGICAL GARDENS,
TRIVANDRUM,
January 12, 1943.

E. S. SIMON,
Curator.

V.—BREEDING SEASON OF THE INDIAN SAMBAR (*RUSA UNICOLOR*, KERR).

It has been mentioned about the Indian Sambar (*Journal Bombay Nat. History Society*, vol. xxxvii, No. 1 (1934), 'Wild Animals of the Indian Empire and the problem of their preservation', Part II, p. 77), that 'there is much variation both as to the pairing season and the time at which the antlers are shed'. Again on page 78 it is said that 'pairing takes place in November and December . . . . The young are born at the commencement of the rains in late May or early June'.

Though there may be regional variations, observations made of a herd of Sambar, numbering over two dozen kept in the Trivandrum Zoo, have tended to establish definite periods with no wide range, as regards the seasons for the shedding of horns, mating or birth of the fawns. The seasons for these differ from those mentioned above. Unlike other *Cervidae* which have been seen with young ones or with shed antlers at all seasons, all the Rusa deer stags were observed to cast their antlers in May. Pairing took place in late June and early July. A dead hind in mid-July last year, was found to contain a foetus of a few weeks development. Between the middle of December and the third week of January this year, eight young ones were born. Each hind has given birth to a single fawn and the period of gestation has been six months.

GOVT. ZOOLOGICAL GARDENS,
TRIVANDRUM,
January 21, 1943.

E. S. SIMON,
Curator.

VI.—SMALL GAME SHOOTING IN THE SALEM DISTRICT.

East of Salem, between the Shevaroys and the Chitteris and the hills to the South of them, a narrow neck of flat country broadens out into the great empty spaces which extend to the coast. At the eastern entrance to the gap, where thankfully there is always a welcome breeze a considerable variety of sport can be found with a scatter-gun, from jungle fowl in the hills to sandgrouse on the plains, and wild fowl on the tanks, all within a radius of five miles. By far the biggest item between October and March is wild fowl, which arrive in at times vast legions, until every tank (of which there are far too many) is solid with them. The impossibility of assembling flighting parties at the right moment, and the complete inadequacy of their strength when it could be arranged, was tantalizing with so many birds about, and many occasions went by when red-letter bags might have been made. I should like to know whether anyone has shot in this area in recent years. There were no indications of it, judging by the astonishment of the natives at our activities, local talk, and the inexperience of the duck themselves when we first started operations.

Before their arrival I had odd walks after sandgrouse. Only a few small parties inhabit the intermittent barren stretches of country, and there are too few, and too much water, to shoot them properly at flight. Two species occur, common and painted, the Common Sandgrouse predominating in the autumn, while after Xmas I saw only painted. They mixed together, and one 'doublet' I got out of a bunch of five contained one of each. Beyond the sandgrouse, only grey partridges which are common, presented a quarry, but not a sufficiently exciting one to justify the reduction of my previous ammunition supply. Jungle fowl are fairly abundant in the Chitteri Hills, but the organization required to shoot them in those impenetrable thickets did not make them a proposition. The snipe, too, were resisted, when they arrived early in October.

I was determined to save every round for the ducks. There were ten pintail to every common snipe and a few of those queer rail-like birds, painted snipe, which seem so inappropriately named. By now, thousands of migrants had arrived, most of them first seen in August, green and wood sandpipers, Temminck's and little stints, stilts and greenshanks (grand to see old East Anglian friends again). But still there were no duck, beyond one or two dull pairs of spotbills.

At last on October 3, I saw three garganey and after a skilful drive by my batman I got one, and should have had two. However I had got a duck, my first East of Yarmouth! During the ensuing days pintail and garganey poured in. I erected a hide on the nearest tank and went out for an hour one evening with another gun on the next tank. The pintail flew well between us, and I got seven, but after a time they cleared off, and went and sat on the other tanks. This paltry effort obviously did not meet the case, and I attempted to mobilize every gun in the area and organize a proper flight. But naturally much success was not possible, and the largest party we ever mustered was five. With twenty large tanks, not more than a mile between each, we could not hope to keep the birds on the move and the story was always the same. After a grand hour at day-break, during which we had excellent sport, every duck disappeared to find more peaceful surroundings in which to pass the day only a couple of miles away. At each flight I increased the number of 'disturbers' on surrounding tanks, but to do the thing properly I needed twenty guns and fifty disturbers—for which I fear this shoot must wait until the 'piping days, etc.' But I recommend it to anyone then, if I am not here to partake myself (personally I hope it will be the desolate saltings of Essex, or the iced-fringed creeks of the Solway!)

The other problem was caused by the unsuitable nature of the tanks for shooting. They are large and round, with banks like golf greens: not a suspicion of cover. I put up the hides as far out as possible, but the duck were always near the middle, and just out of range, and not until I made my floating butt did I come to grips with them properly. This was an excellent answer, the butt being a simple construction of bamboo and petrol tins (now dutifully returned to their lawful occupation), tied together with string and covered with palm leaves. I cannot imagine why we never thought of this at home, where time and money has been spent building enormous erections on twenty-foot poles. When anchored, the new model is surprisingly steady, as a shooting platform, and is easily transported to any tank desired. It is the most important result of the season for me.

Garganey and pintail were the most common throughout. I saw only one cotton teal, on November 12, and on that day the first tufted duck, which were fairly common all the winter. One or two big flocks turned up at every flight, circling round obligingly and giving every one a crack before they made off. Teal appeared early in November, but there were never very many. There were no pochard, but I saw big flocks of red-crested pochard further to the east and nearer to the coast a single pigeon, a young cock. I shot one shoveller and again he was the only one I saw, until four appeared on March 21. On October 15 an enormous flock of nukta flew by while we were building hides for next morning; it was their only appearance. All these were isolated incidents and the only birds permanently present were pintail and garganey, always in large numbers, and sometimes tufted and teal, and of course a few spotbills.

The duck effected a strange and total disappearance immediately after Xmas. Not a bird was to be seen during January and I assumed that our sport was over. But to my surprise and delight pintail and garganey appeared suddenly on February 5, followed by a few tufted and we had one perfect flight. I have no idea what caused their absence for six weeks, but in my experience at home such an event would merit some definite explanation. There was no drastic change in the water-level and nothing particularly interesting about the weather. I am at a loss.

Most of the duck remained until the end of February and I saw the last garganey on March 31.

Lastly the geese. Wild geese are my obsession, but I had never hoped to see any, as I assumed we were too far south to come within their range. There are no marshes and no big rivers, and as I associate geese with the gale-swept desolation of the waste and other similar scenes, I could never imagine them perspiring in the heat of the day round a circular tank. However I was elated to a degree to see thirteen bar-headed geese, with a dozen spoon-bills, on December 3. They were padding about on the margin of a tank and I hurried home for my fowling piece and batman, by now an expert at driving the wily fowl. We sat long behind a rock, deliberating on our plan, and regarding them hungrily through a telescope. Finally I crawled out on to a spit at the far side of the tank, within range of which I hoped the breeze would swing them. But when they took wing they did completely the wrong thing, climbing in the opposite direction. I was about to emerge from my position, when they turned and headed back towards me, and actually glided straight over my head, at an absurd height for my No. 6 shot, all I had. However to my astonishment my bird fell like a stone, probably one pellet in its head—a fearful fluke! But the local audience were suitably impressed, and I was delighted.

One more lot came on January 20, this time about seventy. A drive was arranged for them and this time they came low and two seemed already in the bag. But I had a dud cartridge in the right barrel, and so picked up one. It would happen with geese.

TACTICAL SCHOOL,
POONA,
April 14, 1943.

AUBREY BUXTON,
Capt.

VII.—WOODPECKERS FEEDING ON FRUIT.

As within the last week or two I have noticed both the West Himalayan Scaly-bellied Green Woodpecker (*Gecinus squamatus*), and the Black-naped Green Woodpecker (*Gecinus occipitalis*) eating berries on the trees here in Murree, I should be glad to know whether such a diet is usual with these birds.

St. Denys' School, E. A. STORRS FOX,
Murree, *Senior Chaplain, I.E·E.* (*Retd.*)
December 12, 1942.

[Woodpeckers are essentially insectivorous, a frugivorous diet is unusual.—Eds.]

VIII.—THE EGGS OF THE INDIAN BAY-BANDED CUCKOO (*PENTHOCERYX SONNERATII*).

On page 72 of 'Cuckoo Problems', Stuart Baker writes of the Bay-banded Cuckoo :—

'In the south of India Davidson, Bell and Stewart found them breeding fairly freely and took eggs in the nests of the Ioras, Red-whiskered Bulbuls, and small White-throated Babblers and saw these birds feeding young Cuckoos of this species. A few of the eggs I have seen from Travancore and the Western Ghats are certainly like some eggs of Red-whiskered Bulbuls, but none are in any way like those of Iora'.

On the 3rd August, 1941, I shot a female at Khandala (Western Ghats) with a shelled egg in the oviduct. The egg was damaged by the shot, but the remains have been preserved and the egg agrees with an Iora's—white background with sparse reddish-brown blotches and streaks heavier towards the thicker end. There were numerous enlarged ova together with this egg, and the bird (wing 128 mm.) was in heavy moult.

I am sending you the egg herewith and I shall be glad if you will forward it either to Mr. Stuart Baker or anybody else who is interested, when transport is safer.

C/o Messrs. Faiz & Co., HUMAYUN ABDULALI.
75 Abdulrehman Street, Bombay, 3.
February 12, 1943.

IX.—GREEN PIGEONS IN A SWAMP.

One naturally associates green pigeons with banyan and similar fruiting trees, and it was therefore with some surprise that I put up a couple in a swamp near the village of Munderi up the Kakod backwater and some 7 miles direct north-east of Cannanore, on 17th March last. I was at the time not too hopefully looking for belated snipe and was working with a line of men through a swamp covered with short reeds. Here and there a small hole had been excavated and the black saline earth thrown up round the edge. it was from one of these waterholes close in front of me that two green pigeons rose and flew back over the line, to perch on a cocoanut palm some 200 yards away. I could not be sure of the species but think they were Grey-fronted (*O. pomapadora*) and not the Southern Green (*C. phoenicopterus*).

Green pigeons so seldom visit the ground that this fact alone seems worth recording, but the incident raises another point of speculative interest. In 'Birds of Southern India' Col. Baker quotes Jerdon's remark that large numbers of Imperial Pigeons annually visit a salt swamp in the neighbourhood of Cannanore in the hot weather, and adds that though he lived some years at various times at Cannanore he had never seen or heard of this swamp nor could he get any information about it. I also have tried without success for many years to locate it. May it not be that the place where I found these green pigeons is the swamp to which Jerdon refers and that they visited it for the salt earth on the analogy of deer visiting salt licks? True they were green pigeons and not imperials, but if the latter have acquired this habit there seems no reason why the former also should not have it. That imperial pigeons eat earth at salt licks is mentioned on page 359 of Smythie's 'Birds of Burma'. I would add that in 25 years' experience of the country round Cannanore I have never seen a green pigeon before in the coastal area; but then I have never visited the swamps so late as mid-March.

BANGALORE, E. G. PHYTHIAN-ADAMS,
April 10, 1943. *Major, I. A.*

X.—SOME NOTES ON THE COMMON SANDGROUSE (*PTEROCLES EXUSTUS* TEMMINCK) IN KAIRA DISTRICT.

(*With a plate*)

I have kept notes on matters of shikar and natural history interest in Kaira District since 1930, and the following observations are based on these.

Pterocles exustus is the only sandgrouse found in Kaira District.

Distribution.—Found ordinarily only in small numbers along a relatively narrow belt bordering the western limits of the district. This belt widens both in its northern and southern extent; especially in the south adjoining Cambay State where the character of the country is more suitable; that is drier and barer sandy patches of land with scattered areas of cultivation near large barren plains. The common sandgrouse is a resident of the district, but the numbers to be found in any given year depend largely on the rainfall of the previous season. There seems to be a certain amount of local migration into and from the drier portions of Kathiawar, and the number breeding in the district varies considerably with the season. Ordinarily there must not be very many that nest in the district.

During the period under observation the rainfall was average or above average from 1930 to 1934, and during these years sandgrouse were seen only occasionally. From 1935 to July 1941, each succeeding year the rainfall was increasingly below average; 1939, 1940 and 1941 being extremely dry. In April 1940 the Vatrak river, just above its point of junction with the Sabarmati, was completely dry; the first time, according to the local villagers, that it had been so, since the famine year of 1900. At the same time many deep wells that had never been dry, went dry. It was during 1939, 1940 and up till the rains in 1941 that a marked increase in the numbers of sandgrouse in the district was noticed. During this period they were plentiful and some nests were found. In the following two years, 1941 and 1942 the rains were exceptionally heavy, above average for the district, and sandgrouse again scarce; and they are still so at the present (April 1943).

Nesting.—In the months of December, January and up till the end of February in 1940 and 1941 grouse were found in enormous flocks of several hundreds. Sometime during the last week of February these large flocks could no longer be found. Those then seen would be in scattered pairs or small flocks of six or eight here and there. The question arises whether this increase in the size of the flocks during December, January and February, is connected with pairing and breeding or whether it represents a preparation for a local migration of a certain number over into Kathiawar and the northern drier sections of the country.

The following are some extracts from my notes on nests and young:—

March 20, 1940. Saw, while riding in our car, about noon, a pair of common sandgrouse out in an open plain near Radhu. The hen was sitting on a newly scrapped out shallow depression, with the cock standing nearby. We drove up cautiously until we were within about eight feet of the pair without disturbing them. Watched them for some time from our seat in the car. (Unfortunately did not have the camera with us). It was only after my wife stepped out of the car that the pair flew off. The nest consisted of a simple depression in the ground, unlined, placed next to a lump of dried cowdung. There were no eggs.

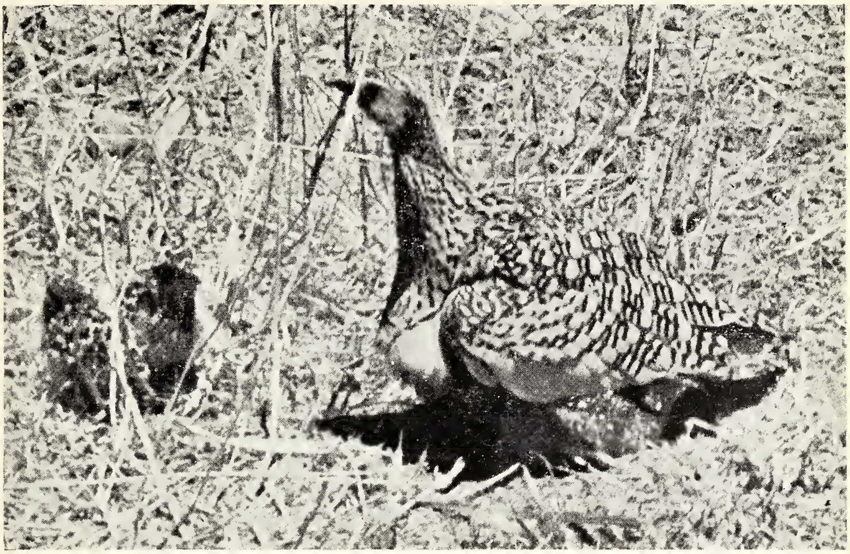
March 27, 1940. Went back to photograph the sandgrouse and nest seen on March 20th near Radhu. Found the nest deserted. There were a few pieces of egg shell lying in and around the nest. Robbed?

May 22, 1940. West of Traj; saw a pair of grouse with two recently fledged young dusting themselves in an ox cart road. The wings of the young were fully feathered and they could fly.

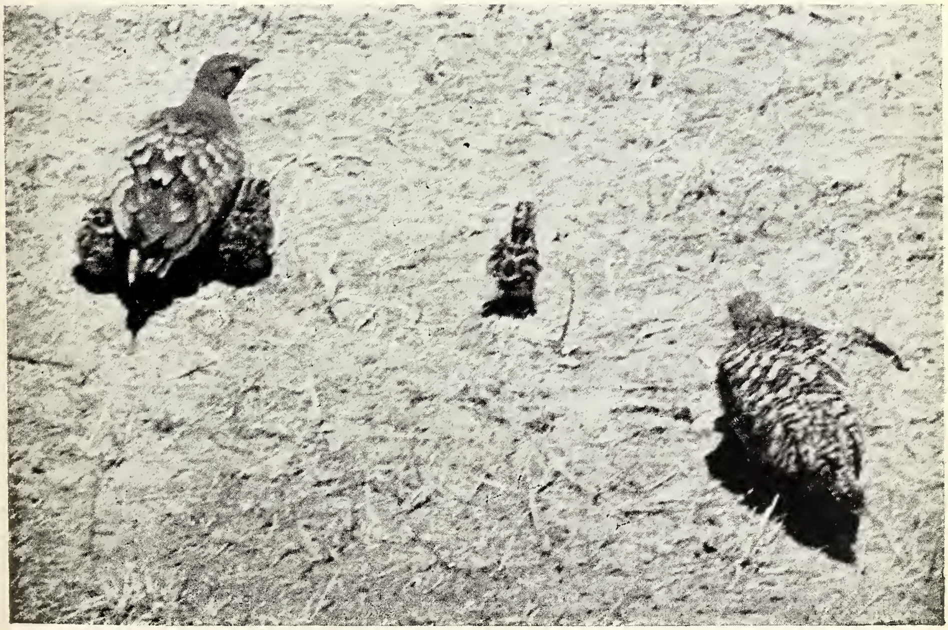
Feb. 12, 1941. West of Traj near the Vatrak river, saw several good-sized flocks of sandgrouse. Shot ten; of these, two of the hens were found to be with fully matured, and hard shelled oviduct eggs. The testes and ovaries of most of the others were enlarged.

Feb. 19, 1941. Wank. Saw several very large flocks of grouse coming to water between 10 o'clock and 11-30 in the morning. Shot 19 birds. All of the testes and ovaries of these were in an

COMMON SANDGROUSE (*Pterocles exustus* Temm.)



1. Female with one chick under her wing and two standing in front of her.



2. Male, female and three chicks attempting to escape by slowly creeping away.

[*Photos by Author.*

enlarged condition. One hen was found with a soft shelled oviduct egg.

April 30, 1941. Jakhara; while riding in our car, found a family of common sandgrouse, cock, hen and three chicks in down plumage. Was able to approach very closely to them by manoeuvring the car carefully. Got some good photographs with the birds in various positions. Whenever we would attempt to drive up towards them, in gradually narrowing circles, they would slowly creep off away from the car; always keeping their tails pointing towards us, changing their line of retreat with each change in the position of the car. They remained always in full view, and made no attempt to take advantage of any cover, though they several times passed clumps of dry grass and a small thorny bush. Throughout the manoeuvres the three chicks were constantly making an attempt to keep under the tails or next to the bodies of one of the parent birds. All of the birds seemed to suffer considerably from the heat while being shifted around in the bright afternoon sun; especially the chicks which could be seen breathing rapidly through open beaks. The chicks though able to walk freely, and appearing to be at least five or six days old, were not able to walk very steadily. Two or three times one or the other would upset in some small crack or depression; and they did not seem to be able to move very rapidly. (Partridge chicks of this age would have been very difficult to catch by hand). The parent birds fully appreciated the dangers their chicks were being exposed to from the air (hawks); they were constantly scanning the skies for a possible enemy. We did not get out of the car at any time. In all probability, the adult birds would have flown off to some nearby spot and the chicks would have perhaps 'frozen.' After taking several photographs from the car we left them undisturbed.

May 7, 1941. West of Kaira across the Vatrak river. Found a sandgrouse's nest out in an open patch between two uncultivated fields. The nest consisted of a small shallow depression, loosely lined with a few pieces of dried grass, and was placed between two small tufts of dry grass. It contained two hard-set eggs. The female bird was on the nest when discovered, but flew off immediately when approached.

(The technical details of the two photographs; enlargements of which are illustrated, are :—Taken at about 2 o'clock in the afternoon, very bright sunlight, with birds at a distance of about twelve feet from the camera. Camera Super Ikonta fitted with Zeiss Tessar F4.5, 10.5 cm. lens. Pictures taken on Panatomic—X film, at F16, 1/50 second. It should be noted that grouse are protectively coloured; and as they match their background so closely, are difficult to photograph satisfactorily, because of a lack of contrast between subject and background).

NADIAD, HERSCHEL C. ALDRICH, M.D.
KAIRA DISTRICT,
April 13, 1943.

XI.—OCCURRENCE OF THE CLOSE-BARRED SANDGROUSE (*PTEROCLES LICHTENSTENII ARABICUS*, NEUM.) IN THE N.W.F.P.

I am also sending you the skin of a Close-barred Sandgrouse. This bird was shot near Alizai in the lower Kurram at an elevation of about 3,000 ft. above the sea level. It is described in Game Birds of India as being only found in Sind within Indian limits. Major Francis, Commandant of the Kurram Militia, who shot the bird, said that it was one of a small pack of 4 or 5 birds. They allowed the guns to approach quite close before getting up and even after being shot at came and settled quite close again after circling about a bit.

I shot a specimen of this bird two years ago near the village of Mullazai in the Tank sub-Division of the Dera Ismail Khan District. It was one of a party of 6 birds and they behaved in much the same manner as described above. Mr. Emerson shot one near Sarwekai in Waziristan, as far as I remember, at about the same time.

PARACHINAR,
KURRAM VALLEY, N.W.F.P.,
February 7, 1943.

J. O. S. DONALD,
Major.

XII.—LATE STAY OF SNIPE AND WEIGHT OF PINTAIL.

Yesterday i.e., 11th May 1943, close to Madura, I shot a snipe, a pintail, weight $5\frac{3}{4}$ ounces. He was with three Painters in rather dry stubble. This was a very late bird, and is possibly a record. He did not seem to be a wounded bird.

I shot a number of snipe here also on 1st May 1942.

MADURA.
May 12, 1943.

J. BECKETT, I.P.,
D.I.G. of Police, S.R.

(The heaviest pintail so far recorded is a bird weighing $12\frac{1}{2}$ tolas (about 7 oz.) shot by W. Gaye, at Secunderabad on the 6th January 1890. The average weight is about 4 oz.—EDS.)

XIII.—THE WHITE-FRONTED GOOSE (*ANSER ALBIFRONS* SCOP.) IN ASSAM.

I am writing to you to record the occurrence of the white Fronted Goose in Assam. As Stuart Baker refers to this goose as a rarity in Western India and quotes no authenticated instance of its being shot in Assam, the record may be of interest to members.

Some geese were reported to be down on the bheel near my bungalow (on the 7th of January) and on going out with the glasses I saw at once that the birds were neither grey lag nor bar-headed. It was the middle of the morning and three geese of a very dark colour were standing out in the sunshine on the edge of a pool, in the middle of the open bheel. I could see no way of getting within shot and expected them to get up any moment and fly off to the Brahmapootra. However, I left my labrador with a boy on the south side of the bheel to engage the attention of the geese, and making a wide détour crossed the bheel and got between the geese and the river. An exciting stalk then began; the going was very soft and entirely exposed and the geese, I could see, were very uneasy—one, as usual, the sentinel, head up, was staring in every direction; my only hope was a small herd of cattle grazing nearby, these I managed to work slowly towards the geese, creeping up when covered and crouching, still, when exposed. I had nothing but No. 8—so a pot shot was my only chance, eventually the cattle drifted apart and I had to take a long shot; he floundered about in the pool, but was retrieved in great triumph, one pellet had struck him in the head—his companions made off for the big river. He was in fine plumage and of course quite unmistakable, but the dark colouring was rather more dark ashey than dark brown as shown in Stuart Baker's plate.

I showed the goose to Mr. Buckingham Jones of Dibrugarh, who is a keen ornithologist, and was greatly interested.

My reference to the 'big river', the Bramapootra, reminds me of the derivation of the name given by the local 'uneducated' Assamese—who even today call it the Borompootar—in Assamese '*bor*' is big and, of course, '*putra*' spring or river. Sir Samuel Baker, in his books, always spells it (in italics) 'Borrompooter'—the name is understandable—the big river—the original inhabitants were animists and knew nothing of Brahma but it was easily corruptible into Brahmaputra, and, lately, German highly coloured prints used to be for sale in Dibrugarh for four annas depicting the 'Brahma'-putra gushing from the head of the God seated on a throne and surrounded by people somewhat resembling Hitler & Co.

MOTHOLA COMPANY LTD.,
DIBRUGARH, ASSAM,
January 26, 1943.

D. J. MONTAGNON.

XIV.—GYNANDROMORPHISM IN THE COMMON TEAL (*ANAS CRECCA* LINN.)

The Society recently received from Mr. H. W. Porter, Baluchistan, the head of a Common Teal shot at Quetta on 26th December 1942. The left side of the head shows the normal colouration and pattern of the adult male in summer and winter plumage; the right side is that of the adult female (or of the male in eclipse). A detailed description is given below:

Left side: As in adult male summer and winter plumage. Cheeks and lores chestnut. Thin cream-coloured lined from gape upwards along base of upper mandible over and under eye to nape, enclosing broad band of metallic green. This band still with slight admixture of a few unmoulted cinnamon-tipped brown feathers at its posterior end, near nape. Extreme point of chin (for 4 or 5 mm.) brown, the feathers tipped buff. Forehead, crown and nape as in adult female, i.e. black-streaked brown, the feathers edged with buff on forehead and cinnamon-buff on crown and nape. Throat and foreneck particoloured medially, chestnut on the left side contiguous with the cheek, and whitish-buff on right. The division between the chestnut and whitish-buff is not clear-cut but some of the chestnut 'flows' into the white and vice versa.

Right side : As in adult female or in eclipse plumage of adult male. Cheek buffy-white. Upper throat and foreneck light buff more or less thickly spotted or streaked with blackish-brown. Indistinct blackish-brown streak from behind eye to nape. A tiny whitish patch under eye (also present under left eye). A single metallic green feather behind and slightly above eye the only indication of the broad metallic green band on the opposite side of the head.

Unfortunately merely the head, i.e., skull with mask (severed at the 'halal' cut) has been sent to us. The covering letter mentions that the rest of the plumage was female, but I feel that a critical examination would probably have shown the same bisexual characteristics as are present in the head. Also a morphological examination and dissection of the body would have proved of the greatest interest. The letter further remarks that the bird's right leg was missing below the tarsal joint. This may be accidental or congenital, and may or may not have to do with the otherwise abnormal condition.

The case is a highly interesting one and represents what I believe to be the first known occurrence in the Common Teal of that curious abnormality known as Gynandromorphism. Bird gynandromorphs or gynanders wear male plumage on one side of the body and female on the other; they are very rare and not much is known about them especially in life. Instances have been recorded in the Bullfinch (*Pyrrhula pyrrhula*), Chaffinch (*Fringilla coelebs*), Siskin (*Carduelis spinus*), the Pheasant (*Phasianus colchicus*) and in certain members of the families Ploceinae (Weaver Finches), Coerebidae (Sugarbirds of South and Central America), and Picidae (Woodpeckers).

In several examples that have been dissected a testis was found in the male half of the body (in most cases the right half) and an ovary in the female half. But sometimes this arrangement was reversed, as it presumably also was in the present case. Gynandromorphism is apparently less rare among insects, the commonest and most striking type being, as in birds, where the male and female halves of the body are sharply delimited lengthwise along the middle. In others a quarter of the body may be of one sex and three-quarters of the other. In some examples it is even less in extent, only patches of the characteristic form and colouration of one sex appearing on the body of the other. Natural gynandromorphism is apparently quite independent of the influence of sex hormones and is explained by an aberration in the chromosome distribution in the development of the gametes. And here a little digression is perhaps desirable.

Sex hormone is a chemical secretion of the gonads (testes in male; ovaries in female) which pours into the blood-stream in the same way as do hormones from the other ductless glands situated in various parts of the body, collectively known as the endocrine system. It circulates with the blood and is known to control the secondary sexual characters such as the beard in Man, antlers in most deer, and the plumage in sexually dimorphic birds. But it can obviously influence an organism only *as a whole,* and therefore the possession by a gynander of both male and female sex glands could not by itself account for the clear-cut bipartite effect, for instance as seen in the plumage of bird gynanders.

'Cock-feathered' female pheasants are well known. It is also known that this peculiar condition is brought about by damage to the bird's ovary—atrophy, either through old age or disease. It has been proved experimentally that female feathering in the domestic hen (and presumably also in its wild relations) is due entirely to the influence of the female sex hormone discharged into the blood by the ovary. If the ovary of a domestic hen is removed—an operation known as ovariectomy—it will assume cock plumage at the next moult including the long tail. This is because the influence of the female sex hormone, on which hen feathering is dependent, has been removed. If a cock's testes are removed—by castration—although certain other changes such as shrinking in size of the comb will soon be observed, yet its plumage at the next moult will grow again unaltered in appearance. This proves that 'cock feathering' is really speaking the 'Neutral' phase of plumage and not dependent upon the male sex hormone. Thus by castrating a cock and ovariectomising a hen it is possible to produce 'neutral' birds that look closely alike. This neutral bird, however, can be further changed to male or female by engrafting it with the relative male or female gonads.

With the exception of some raptores chiefly of the genera *Falco, Accipiter* and *Circus* and certain other birds which possess paired functional ovaries, the general rule is that only the left ovary is functional while the right is suppressed and remains vestigial. Experiments show that if the left ovary of a bird is removed the right one, till now dormant, develops. But the curious point is that it develops not into an ovary to replace the missing one as one would expect, but actually into a male testis ! Thus a hen in which the left ovary has been removed soon develops into a cock. The sex hormone released by the newly formed testis brings about, in the erstwhile hen, all the characteristics of appearance and behaviour of the cock even to the extent of attempting to mate with hens. Effective mating is however rendered impossible owing to anatomical disabilities, but an exceptional case is on record where such a sexually reversed bird, a good egg layer up till 3 years old began to crow at 3½, and took on most of the male characters. At the age of 4½ on being mated to a virgin hen it became the father of 2 chicks ! It will thus be seen that it is actually possible to produce a cock (in this case even a perfectly functional one) by removing the left ovary of a hen !

As distinct from the *Natural* (due to chromosome derangement), *Artificial* gynanders have been produced in the laboratory thus: A cock was plucked of its feathers on one side. It was castrated and implanted with an ovary. Under the influence of the female sex hormone, the plucked side soon developed female feathering so that until the next moult that bird presented the characteristic bipartite appearance of a natural gynander. At the next moult, however, the male half of the feathering disappeared and was replaced by female plumage all over.

33, Pali Hill,
Bandra, Bombay.

SÁLIM ALI.

XV.—OCCURRENCE OF COMB DUCK (*SARKIDIORNIS MELANOTUS* PENN.) IN MYSORE.

With reference to Mr. R. F. Stoney's note xiii on p. 525 of vol. xliii, I have to record shooting a Comb duck (female) about 50 miles west of Bangalore on 14-1-43—the bird was solitary. This is the first of the species shot by me in S. India though I had definitely seen it once previously near Gundlupet, 40 miles south of Mysore City.

Bangalore,
January 18, 1943.

E. G. PHYTHIAN-ADAMS.
Major.
I.A., F.Z.S.

XVI.—RED CRESTED POCHARD (*NETTA RUFINA* PALLAS) IN MADRAS PRESIDENCY.

As reports of this duck in the Province appear to be scanty, it may be of interest to record that I shot a male from a flock of about 30 on a tank near Cumbum in the Kurnool District on 11-12-1942.

Bangalore,
January 18, 1943.

E. G. PHYTHIAN-ADAMS.
Major.
I.A., F.Z.S.

XVII.—NOTES ON THE VIVIPARITY OF THE COMMON INDIAN SKINK [*MABUYA CARINATA* (SCHNEIDER)].

A specimen of the common Indian skink, *Mabuya carinata* (Schneider) was collected from the suburbs of Calcutta on March 11, 1943, for the study of its protozoal contents and helminths by my colleagues Messrs. M. M. Chakravarti and G. K. Chakravarti. It was a gravid female and contained embryos in a fairly well-developed condition. It was handed over to me in a partially dissected condition for the collection and preservation of the embryos, and my thanks are due to my colleagues on this account. In view of the dubious viviparity of this species (Smith, '35, p. 268) it seems desirable to record the following observations.

The specimen was fairly large, measuring 124 mm. from snout to vent, the tail being 149 mm. The eggs with ripe embryos were arranged in fours, one after the other in a series, in each uterus. An ovary with immature ova in various stages of development was found to be located on the left side of the vertebral column very near the left oviducal opening, there being no trace of any other ovary on the right side, which might have been lost while the alimentary tract was removed. The eggs *in situ* appeared to be broadly oval and were about the same size. Unfortunately they had not been measured before the embryos were taken out, but from an ocular examination they were estimated to be 15 by 10 mm. on an average. Although each embryo was in a fairly advanced stage and had pentadactyle limbs well-developed, the egg itself contained much yolk. The outer envelope covering the eggs was thin, colourless and transparent, and the vascular allantoic sac was clearly noticed through it. From this it might be assumed that a calcareous shell had not been so far deposited on the egg. The translucent uterine wall which was very much thinned out presumably owing to the lodging of the developing embryos enabled me to notice also the movement of the embryos as well as the allantoic circulation.

It should be noted that I did not much care to determine how the eggs were held in the uteri, especially the mode of their attachment to the wall of the uterus, as recorded in certain lizards giving some hints of placental connection (Kerr, '19, p. 483).

The embryos were carefully removed from the eggs and fixed in the aqueous Bouin's fluid. It was observed that the embryo within the egg lay snugly curved upon itself, while the long tail was coiled a few turns and hugged between the limbs. All the embryos appeared to be more or less in the same stage of development. On the following day, when they were measured, the length from snout to vent ranged from 22 to 23 mm., with 22.5 mm. as the average, and the length of the tail, between 23.6 to 25.8 mm., with 24.7 mm. as the average.

Although the embryos look like veritable miniature skinks, their morphological characters differ somewhat from those of the adult pattern. The head was proportionately large as is usual in all embryos. The brain was clearly visible through the almost transparent membranous skull. The head and chin shields, so characteristic of the adult, were not yet developed, while a uniform non-overlapping squamation covered the rest of the body, viz., throat, trunk with limbs and tail. The eyes were prominently developed, and the lower eye-lids without any scales. It is interesting to note that the parietal organ which is so characteristic of almost all lizards (Sedgwick, '05, p. 344), was seen very clearly under the binocular microscope, in the form of a dark-ringed fleck on the middle of the head of the embryos. This parietal fleck was, however, not evident in the adult female specimen from which the embryos were removed. The ear opening covered by the tympanum was not yet deeply sunk. The limbs were well-developed, as noted before, with fully-formed digits. The fingers, and especially the toes, however, had not attained the characteristic pattern and relative proportions of the adult. Pigmentation did not occur in any part of the embryo. No 'egg-tooth', such as occurs in very many lizard embryos at the extreme tip of the snout, was observed. From the data at hand it cannot be decided whether

M. carinata produces young alive or lays eggs containing ripe embryos only to be hatched soon after.

With regard to Gadow's ('01, p. 560) sweeping statement: 'all the Scincidae seem to be viviparous', Malcolm Smith ('35, p. 256) expresses an element of doubt, since he has recorded more oviparous forms than viviparous ones. He holds that viviparity is possibly true of the majority of the Australian skinks, but not of the Oriental forms. He states further that so far as is known of the Indian genera of Scincidae, all the species of *Tropidophorus* are viviparous, and of the rest only four species belonging to three genera, viz., *Mabuya aurata, M. m. multifasciata, Lygosoma i. indicum* and *Leiolopisma himalayanum* are recorded to be viviparous. Closely related species and even genera frequently adopt either method of breeding, and from this point of view the genus *Mabuya* becomes extremely interesting in that the 'closely allied species may produce young by either method, for example, *Mabuya carinata* and *M. multifasciata* or *M. dissimilis* and *M. aurata'* (Smith, '35, p. 6). Boulenger (1890, p. 190), however, under the species *Mabuia macularia*, notes, 'this species is stated by Theobald to be oviparous, whilst its close ally *M. carinata* is, like most Scincoids, viviparous.' Perhaps to this statement Malcolm Smith (*loc. cit.*, p. 268) has taken exception, and reiterates in reference to the species *M. carinata* particularly, 'it is usually stated that this Skink is viviparous, but such is not the case. A female kept by Father Dreckmann in captivity laid 23 eggs; from another female he removed 22 eggs. All are of about the same size, approximately 13 by 8 mm.; none of those examined shows any trace of embryo. Both clutches are now in the British Museum.' From the above statement it is quite apparent that Malcolm Smith lays considerable emphasis on the oviparity of *M. carinata*. But the observations recorded by me above on *M. carinata* differ from those of Father Dreckmann. It appears to me, however, that the eggs obtained by Father Dreckmann were in all probability either infertile or in a very early stage of development.

Now the point is whether *M. carinata* can be called viviparous or not. It may be pointed out that Malcolm Smith ('35, p. 263 and p. 269) notes that *M. aurata* contains eight almost fully developed embryos, while *M. m. multifasciata* produces five to seven young ones. Both the species, in his sense of the terminology used, are viviparous. From this emerges the view that a female specimen containing embryos in the uterus may as well be described as viviparous. It may also be noted in this connection that Gadow ('01, p. 499) in general consideration of the Saurian eggs states, 'many Lizards do not lay their eggs until they contain ripe embryos, which burst the shell shortly after deposition. Some, for instance *Lacerta vivipara, Anguis fragilis,* and *Chamaeleo pumilus*, are practically viviparous.' Further, Graham Kerr ('19, pp. 482-83) is of the opinion that there are three steps in the evolution of viviparity in reptiles. In the first type are included those forms (*Anguis, Vipera, Coronella*) in which the egg is merely retained within the uterus, the egg-envelope persists without having any intimate relations developed between the embryo and the maternal tissues.

Note should be made of the fact that an intra-uterine development of the ovum into an embryo generally takes place before the egg is deposited. As *M. carinata* seems to belong to this type, I do not refer to the other two types described by Graham Kerr. From all these considerations, *M. carinata* is, to all intents and purposes, a viviparous skink, and not an oviparous one as contended by Malcolm Smith. If *M. carinata* lays eggs at all, such as those with embryos as described above, it should rightly be described as ovo-viviparous, and strongly do I suspect that many of the skinks would turn out to be ovo-viviparous in which the hard calcareous shell has been dispensed with. As far back as 1890, Boulenger noted, 'they (Scincoids) are, as far as we know, ovo-viviparous, with the exception of *Mabuia macularia,* which, according to Theobald, is oviparous' (p. 180). Annandale ('10, p. 201) and Okada ('35, p. 56) incidentally lend support to the view that most skinks are ovoviviparous.

A further coincidence of fact that may be noted here is that *M. aurata* and *M. carinata* both contain eight well-formed embryos, while *M. m. multifasciata,* which is a close ally of *carinata,* produces five to seven young ones. But the number of eggs (23 and 22) laid by or removed from *M. carinata* as given by Father Dreckmann (Smith, '35, p. 268) seems surprisingly larger and is no less puzzling. This, therefore, requires further confirmation in the light of present observation as well as from the fact that none of the skinks, especially *Mabuya,* has so far been credited with laying eggs or producing young ones more than nine in number.

McCann ('40) who has recently given elaborate accounts of breeding habits of many Indian lizards, records some brief observations on the two common species, *M. carinata* and *M. macularia,* but he has not noted anything about the breeding habits of the former except that the young ones are numerous during the months of June and July. The presence of young would naturally indicate that hatching must have occurred recently. However, he has given a photograph of the genital organs of a female *M. carinata* which clearly demonstrates that both the ovaries contain immature ova, and that they are situated at different levels, the right one being located slightly anterior to the left. It cannot be made out from that photograph, nor from the text, whether the specimen is a recently parturiated female or not.

Blanford notes (*vide,* Smith, '35, p. 268) that the breeding season of *M. carinata* in the Godavari district is during March, and it is true of the specimen, though single, obtained from Calcutta in March.

JNANENDRA LAL BHADURI.

ZOOLOGICAL DEPT., UNIVERSITY OF CALCUTTA,
35, BALLYGUNGE CIRCULAR ROAD,
BALLYGUNGE, CALCUTTA.
March 29, 1943.

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Since the above article was written and accepted for publication in this *Journal* on April 6, 1943, I have come across a short note on the same subject [An instance of 'viviparity' in *Mabuya carinata* (Schneid.)] written by Mr. R. V. Seshaiya and published in 1938 (*J.B.N.H.S.*, 40, p. 132, 1938). I regret very much to have missed referring to this article. As my observations are considerably different from his brief account, although the conclusion is somewhat alike, I do not like to alter the text of my article. A brief comment may, however, be made here. Mr. Seshaiya did not record, *inter alia*, the number of eggs that were actually present in the uteri and the time of breeding, nor did he add a description of the embryos except that they superficially resembled a 3-day-old chick embryo. It appears that the embryos obtained by him were certainly in much earlier stages of development than those recorded by me above.

ZOOLOGICAL DEPT., UNIVERSITY OF CALCUTTA, J. L. B.
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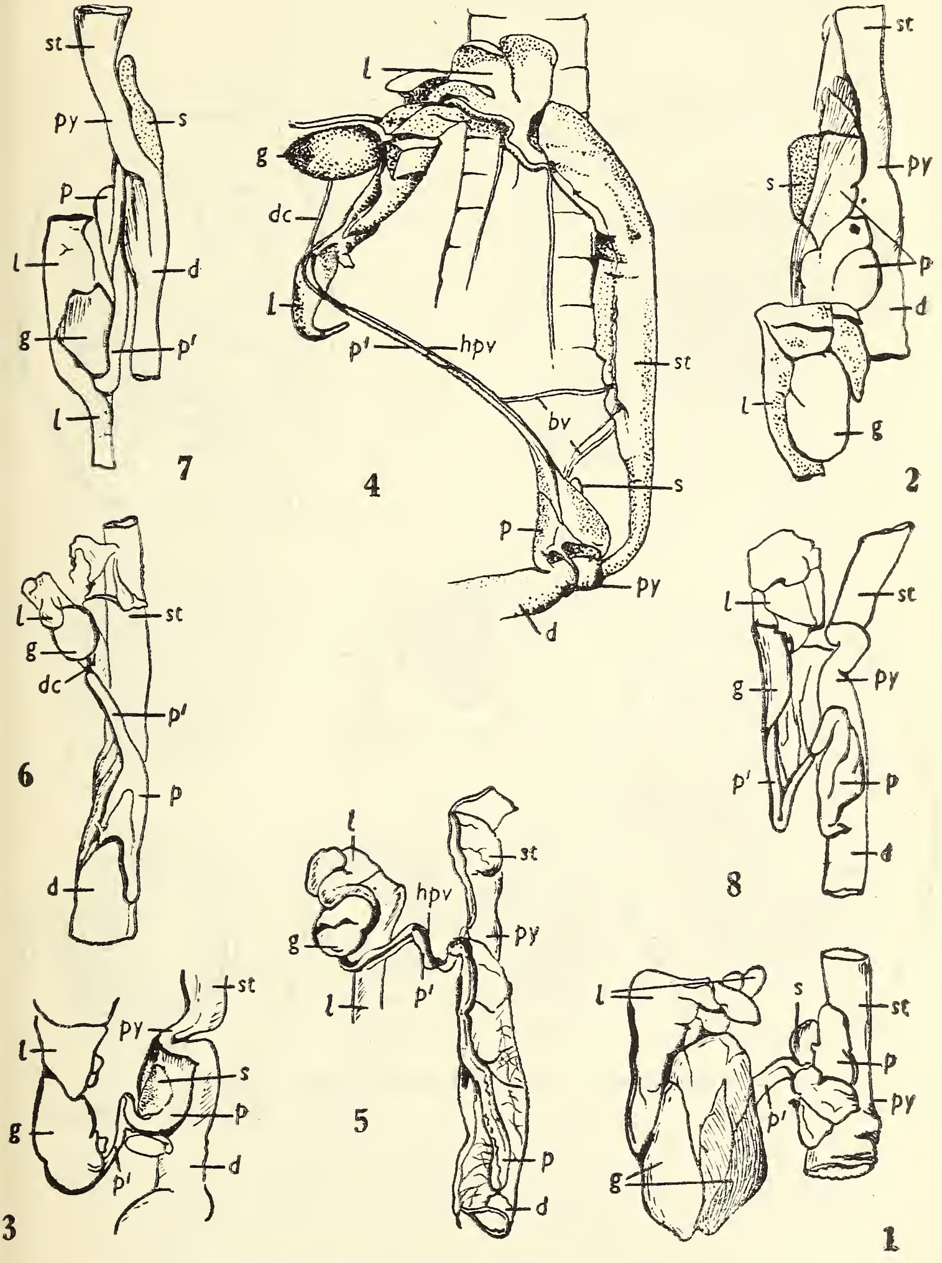
CALCUTTA,
April 28, 1943.

XVIII.—THE ANATOMY OF THE DUODENAL REGION OF SOME GENERA OF APODA (AMPHIBIA).

(*With two plates*)

A comparative study of the duodenal region of some apodan genera was made to note the opening of the hepatic and pancreatic ducts.

In *Anura*, it is common knowledge that the hepatic ducts arising from the liver lobes unite to form a common hepatic duct with which one of the cystic ducts coming from the gall bladder merges to form the ductus choledocus. The other cystic duct opens into the common hepatic duct entering the pancreas. Entering into the choledocal duct, there is a duct (as shown by Wiedersheim) from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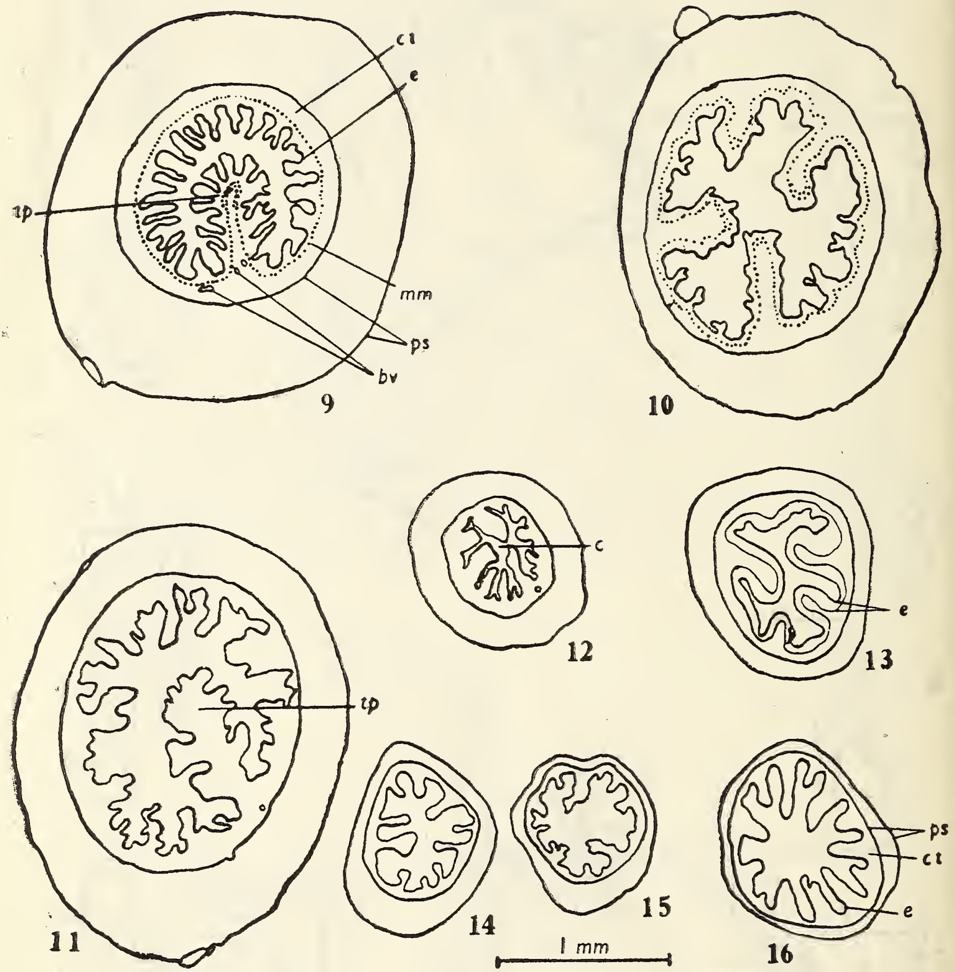
L. S. Ramaswami—Anatomy of duodenal region of Apoda.

(*For explanation see end of note*).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L. S. Ramaswami—Anatomy of duodenal region of Apoda.

(For explanation see end of note).

the pancreas formed by the union of small ductules. O'Donoghue (1925, p. 47) described many small pancreatic ductules opening into the hepatic duct. The choledocal duct enters the duodenum. There are no separate pancreatic ducts, therefore, opening into the intestine.

On the other hand, in *Urodela,* the pancreas throws its secretion into the duodenum by two ducts; of these the anterior opens behind the pylorus and the posterior along with the hepatic duct (Noble, 1931, p. 205). It is noted that the duct corresponding to the anterior one of the *Urodela* disappears in *Anura* (Göppert, 1891); the other opens into the ductus choledocus.

I have examined the duodenal region of the following examples of Apoda both by dissection and by sectioning:—

Ichthyophis glutinosus (Linné); *I. monochrous* (Bleek.); *Gegenophis carnosus* (Beddome); *Ureotyphlus narayani* Seshachar; *Dermophis gregorii* Blgr.; *Boulengerula boulengeri* Torn.; *Herpele ochrocephala* (Cope) and *Scolecomorphus uluguruensis* Barb & Lov.

The gall bladder (text-figs. 1-8, *g.*) situated at the posterior end of the lobulated liver (*l.*) can be clearly seen in a ventral dissection. The cystic duct arising from the dorsal aspect of it joins the large hepatic duct coming from the liver. Opening into the latter are a few hepatic ductules. The ductus choledocus (text-figs. 4, 6, *dc.*) passes through the tissue of the pancreas p^1., *p.*) (the anterior limb of which is situated near the liver) closely associated with the hepatic portal vein (*hpv.*).

The larger part of the pancreas (text-figs. 1-8, *p.*) is associated with the duodenal part (*d.*) of the intestine and it is in this region, i.e. posterior to the pylorus (*py.*) that the openings of the common hepatic and pancreatic ducts are noticed. Tracing sections from the pyloric end, in all the examples studied, a large duct arising from the pancreas opens into the intestine, which therefore, would correspond with the anterior duct of Urodela. In her figure 76 (Pl. xxii) Francis (1934) described the anterior as dorsal duct in *Salamandra.* However, in two examples of Apoda studied by me (*Scolecomorphus, Ureotyphlus*) another smaller pancreatic duct gains entry into the intestine (which may therefore, be called second anterior) before the choledocal duct opens into the gut. Posterior to this choledocal opening, the intestine receives the second or posterior pancreatic duct. In *Dermophis* the posterior pancreatic and choledocal ducts unite before opening. In *Salamandra* also, Francis (1934) described the posterior duct opening into the duodenum by two ductules, one anterior and the other posterior to the common bile duct.

The difference between the anuran and apodan gall bladder is at once apparent. While in the former there is a cystic duct to lead bile into gall bladder from which duct there is another to throw the juice into the choledocal duct, in Apoda, on the other hand, the gall bladder is merely an enlargement of the hepatic duct corresponding to the first type shown by Kingsley (1926, p. 259, fig. 284).

The presence of double independent pancreatic ducts opening into duodenum would naturally relate the Apoda more with Urodela than with Anura.

A word or two about the pylorus may not be out of place here. The series of figures drawn of the pylorus (text-figs. 9-16) of the genera investigated, it is noticed that the pyloric sphinctre is poor in *Dermophis* (text-fig. 15) and *Herpele* (text-fig. 16), fairly well developed in *Boulengerula* (text-fig. 14) and very well developed in *Ureotyphlus* (text-fig. 12), *Gegenophis* (text-fig. 11), *Ichthyophis monochrous* (text-fig. 9), *I. gultinosus* (text-fig. 10) and *Scolecomorphus* (text-fig. 13). In *Ureotyphlus, Gegenophis Ichthyophis* and *Scolecomorphus* where the histology of the pyloric epithelium could be studied with certainty, it is noticed that the gastric epithelium also lines the pylorus; however, glands are absent. In *Ureotyphlus* (text-fig. 12) the cavity is considerably reduced on account of the villi-like projections; in *I. monochrous* (text-fig. 9: not *glutinosus*) and *Gegenophis* (text-fig. 11) there is a 'typhlosole'-like (tp.) projection which starts from the post gastric region and ends in the pylorus. This projection, however, is not continued into the intestine.

SUMMARY.

The duodenal region of the apodan genera examined reveals an interesting feature. There are two pancreatic ducts; one opening into the intestine in front of the choledocal duct and the other along with it or posterior to it. In this respect, the Apoda resemble the Urodela where also two ducts are described; in Anura there is only one duct corresponding to the posterior of Urodela.

I wish to express my thanks to Prof. A. Subba Rau for helpful criticism.

INTERMEDIATE COLLEGE,
MYSORE,
March 10, 1943.

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Dept. of Zoology, University of Mysore.

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EXPLANATION OF PLATES.

Plate I.

Ventral view of the slightly distended duodenal region of:
text-fig. 1. *Ichthyophis monochrous* (Bleek.).
2. *I. glutinosus* (Linné).
3. *Ureotyphlus narayani* Seshachar.
4. *Gegenophis carnosus* (Beddome).
5. *Scolecomorphus uluguruensis* Barb & Lov.
6. *Dermophis gregorii* Blgr.
7. *Herpele ochrocephala* (Cope).
8. *Boulengerula boulengeri* Torn. [all × 6]

bv. blood vessel; *d.* duodenum; *dc.* ductus choledocus; *g.* gall bladder; *hpv.* hepatic portal vein; *l.* liver lobe; *p.* pancreas; *p'.* the thinner anterior portion of pancreas reaching liver: *py.* pylorus; *s.* spleen; *st.* stomach.

Plate II.

Transverse section in the region of the pylorus of:
text-fig. 9. *Ichthyophis monochrous* (Bleek.).
10. *I. glutinosus* (Linné).
11. *Gegenophis carnosus* (Beddome).
12. *Ureotyphlus narayani* Seshachar.
13. *Scolecomorphus uluguruensis* Barb & Lov.
14. *Boulengerula boulengeri* Torn.
15. *Dermophis gregorii* Blgr.
16. *Herpele ochrocephala* (Cope).

bv. blood vessel; *c.* cavity of the pylorus; *ct.* connective tissue layer; *e.* epithelium; *mm.* muscularis mucosa; *ps.* pyloric sphinctre; *tp.* 'typhlosole'-like projection.

XIX.—A NOTE ON FISH MORTALITY IN THE SOHAN RIVER.

(*Comment on Miscellaneous Note, No.* XX, *Vol.* xxxiii, *No.* 3, *p.* 534).

As fishes are very sensitive to free and albuminoid ammonia, acids and alkalis and deficiency in dissolved oxygen in water, any abnormalities of these constituents are likely to prove dangerous. It appears from the report that the water is 'strongly acidic' due to 'free acids' and as such it is harmful to fish life. The p value of water going below 6.7 (7 being the neutral pont) is not conducive to their health. The report does not state what acids were found in the water and how much, but since it is noted as 'strongly acidic' it implies that the p value must be very much less than 6.7 and is therefore dangerous to fish life.

I would advise that samples of water collected from three different places, namely, (1) one from the place where the Leh river joins the Sohan, (2) one from the Leh river before it falls to Sohan, and (3) one from the place about ¼ mile up the Sohan river, be examined. A comparative statement showing the amounts of (1) dissolved oxygen. (2) oxygen absorbed by organic matters (Tidy's process), (3) free and albuminoid ammonia, (4) nature of the free acids if any and (5) the p value of the water (simple colorimetric method will do) along with the usual details of ordinary analysis is very helpful for studying the condition. It is not possible to give a definite opinion about the nature of water which is likely to endanger fish life, unless the above data are available.

CALCUTTA, K. N. BAGCHI, D.SC.,
February 19, 1943. *Chemical Examiner to the Govt. of Bengal.*

XX.—*PAPILIO ARCTURUS* IN THE HIMALAYAS.

As is well known to Himalayan Lepidopterists there are five beautiful species of swallowtails belonging to the blue- and green-spotted group of which *Papilio paris* may perhaps be regarded as the most typical example at the same time as possessing the most extensive geographical distribution of them all not only in the Himalaya but eastward throughout southern China. While, however, *Papilio ganesa* is apparently confined to the south-eastern portion of the chain it is represented west of Nepal by the closely allied *Papilio polyctor* which in the neighbourhood of Simla is well known to European collectors by the name of the monal. The beautiful *Papilio krishna* is, I believe confined exclusively to the south-eastern Himalaya of Nepal, Sikkim and Bhutan. Of the preceding, the first three are strictly sub-tropical being confined to the potter valleys below 3000 feet although individuals are occasionally carried up by ascending currents of warm air, 1000 or even 2000 feet above their usual habitat. On the other hand, the last-named species is a denizen of the cold-temperate zone besides that of the warm-temperate occurring thus within the latter climatical belt at about 3000 feet and from thence ascending up to 9000 feet or so. The fifth species, the special subject of this memoir, *Papilio arcturus* is apparently the only exclusively cold-temperate species of the group of what I denominate the 'Peacock Swallowtails', its habitat comprising the cold-temperate forests at an altitude of between 6000 and 9000 feet. This beautiful species is fairly plentiful in the south-eastern Himalaya, more especially on the so called 'Outer ranges' though I have also met with it in the interior of Sikkim on slopes in close contiguity to the high snow peaks at about 8000 feet. In the immediate neighbourhood of Darjeeling it is of frequent occurrence, where on Observatory Hill at an altitude of nearly 7000 feet I have seen it on the wing during every month from the middle of April to the middle of November, though it is most plentiful in June and July. This species is somewhat seasonally dimorphic and possesses apparently as many as five broods in the course of the year if my observations are correct, the first appearing in the *imago* stage in April, the second in May and June, the third throughout July and August, the fourth in September and October and the fifth during November. As I have not reared it from the caterpillar I do not know however in what stage of its metamorphosis it hibernates or passes through the winter. Although the winters are comparatively mild at Darjeeling, snow being only of very occasional occurrence and frosts, with the exception of hoar frosts, practically absent in most seasons, it would nevertheless be too cold for the *larva* to continue to feed throughout the winter solstice. Accordingly I am under the impression that it is the chrysalis which hibernates. If this is so the perfect insects which appear in April may be representatives of some which did not emerge in the winged state the previous November in consequence of unfavourable metrological conditions; on the other hand they may be the entire product of the fifth brood. Only those entomologists continuously residing on the spot could elucidate this enigma with any degree of certitude however, I presume with regard to their seasonal dimorphism (or trimorphism): the first and fifth broods are closely alike in their small size and the colour of the powdered scales on their wings which are predominantly of a golden bronze instead of the bluish-green of the later broods. The largest specimens by far, besides being the most brilliantly coloured, belong exclusively to the brood which makes its appearance immediately subsequent to the summer solstice and continues on the wing throughout July and August and occurs accordingly at the period of the greatest S.-W. Monsoon deluge, at sunny intervals during which specimens may be always seen on the wing. The second and fourth broods which appear respectively throughout May and June and September into October are about midway in size with regard to the expanse of their wings to the extremes represented by the first and fifth broods in comparison with the third or midsummer form of the perfect insect. During my stay at Darjeeling I obtained a very fine series of this beautiful species, illustrative of all the different broods, which was much admired by my friend Dr. Alfred Russell Wallace when he came to see my collection of Himalayan Butterflies many years ago.

PLYMOUTH, WILLIAM HARCOURT-BATH.
February 6, 1943.

XXI.—CONTROL OF AEDES EGYPTUS (*STEGOMYIA FASCIATA*) OR TIGER MOSQUITO (THE CARRIER OF YELLOW FEVER) IN THE BOMBAY HARBOUR BY A PATENT MOSQUITO-PROOF CAP AND TAP.

Brig.-General Covell, I.M.S., Director, Malaria Institute of India commenting on the discussion on his report on Malaria in Bombay remarked that Bombay was known as the worst Port for mosquitoes in the East as instanced by the repeated complaints made by Ships officers visiting the Port. He simultaneously urged for devising means to control the unlimited breeding of *Aedes egyptus*, the cause of this prevalence of mosquito in the country craft in the Harbour and Docks of Bombay. Since then much water has flown under the bridge. In 1935 soon after assuming the charge of Malaria Preventive Measures in the Port Trust Estates, Docks and Bunders as its Administrative Medical Officer, a preliminary survey of country craft made by me revealed that out of 898 country craft examined, 458 or more than half the number were found breeding *Stegomyia fasciata* giving a ratio of about 51% or that every alternate native craft was breeding the pest. This mosquito breeds profusely in one or more open fresh water receptacles or barrels which are round or oblong, square and box-shaped liberating thousands of adults. Most of these barrels are open or barely covered with a piece of cloth or plank, water being taken in Bombay or along other ports of call in all sorts of conditions. This water when examined revealed not only mosquitoes, but dirt and debris of all kinds including droppings of rats, cockroaches, fibre or coal particles and was drawn by hand for drinking with the risk of conveying diarrhoea, dysentery and cholera germs. As the Bombay Port Trust did not have compulsory powers for examination of the craft at the time, it was decided to continue to carry out the surveys further by examination and emptying out water when necessary by a notice freely circulated urging gentle persuasion and education of the tindal or master of the craft. Many refused at first the voluntary request, but with a full year of working with constant examinations and emptying out, 19453 country craft or vessels were examined in 1935-36 showing a reduction in breeding of 28.7%, in 5688 of the craft so examined when 5551 were persuaded to empty out the infested waters. Fresh water was allowed free from the Docks and Bunders in its place. Progress was made in 1936-37 with the same voluntary working when with the repeated inspections and emptying out, breeding further diminished to 19.3% as seen from figures given below. Improvement continued during the next year to 14.4% in 1937-38, the peak of period of examination of 30602 vessels when the numbers breeding fell to 4412 from 5551 in 1935-36 all complying with the procedure.

This working was detailed and published by me in three preliminary papers (Nos. 3, 4, 5) on the subject as referred to at the end of the article. The following figures give the actual working for the last 7 years:—

Years.	COUNTRY CRAFT. Examined.	Breeding.	Emptied out.	Percentage.
1935.	898	458	358	51 %
1935-36.	19,453	5,608	5,551	28·7 %
1936-37.	22,789	4,338	4,335	19·3 %
1937-38	30,602	4,412	4,412	14·4 %
1938-39.	27,301	3,612	3,612	13·2 %
1939-40.	34,338	2,768	2,768	8·06 %
1940-41.	26,195	1,639	1,639	6·2 %
1941-42.	25,200	1,466	1,466	5·8 %

At the end of 1936, as a result of the voluntary work having been carried out successfully, the Government of Bombay gave the Port Trust compulsory powers by a rule under the Ports Act 1908 section 6 (1) (p) to inspect and deal with country craft so infested within the precincts of the Port and the Trustees appointed their Administrative Medical Officer to carry out the work. Soon after in 1937 a further step was taken in fitting of a mosquito-proof cap with a wooden cork or plug for the open entrances with provision of a separate tap to draw off water. This was at first fitted to our own craft for effectively stopping breeding of Stegomyia in the barrels and was adopted as a standard for others to follow when found successful.

The cap is made of a strong perforated zinc plate with a mesh of 1/16 in. in the shape of an inverted square boater fixed to the opening by screws. It is closed by a wooden cork or plug with a nob on top to which a small chain is attached anchoring it to a side of the opening (for full details with sketches and plans see paper 6). Thus the cap serves as a filter to all impurities and does not allow the imago or full-grown insect to escape even if water be laden with eggs of the mosquito. The cork keeps out cotton, cocoanut and other fibres, dust or coal particles entering it, thus keeping the water sweet and clear and further eliminating risk of contamination by hands dipped into the water. A brass cock or tap is fitted at a suitable distance from the bottom of the cask or barrel to draw water which is used mainly for drinking purposes. The capacity of such a barrel is often some 10-25 gallons for a small and for a big square wooden cistern about 400 or more gallons each carried by country craft coming from long distances like Karachi, Cutch, Kathiawar, Cochin, Arabia, Africa, etc. The whole Western Coast line or littoral of India is infested with this mosquito as shown by craft coming from estuaries and even rivers up the coast such as from Surat, Navsari, Goa and Cochin etc. where water is often taken from wells or step wells.

The gradual diminution in the findings of breeding in subsequent years is an event of evolutionary reduction of the Stegomyia Index due to constant inspections and emptying out of such infested craft, The device if and when adopted to those coming from other ports will still reduce the Stegomyia Index to the normal safe one of 2%.

I am glad to report that so far the caps and taps fitted by kind permission of the Trustees at their Workshops have withstood more than 4 years of hard wear and tear and none of the barrels so fitted have shown any breeding. The advantages of this pucca device are evident in the long service and efficacy of its working the benefits of which are now being appreciated by all owners who often request and send new barrels to be fitted up at our Workshops. Further no drastic action under the powers has been necessitated nor any obstruction offered by the owners or servants plying the boats. It has freed them of the annoying attention of their own mosquitoes bred in man-made receptacles as said by Mhatre and Covell in their reports.

To deal with this nuisance in the Port, for some two decades, both the Bombay Municipality and Port Trust have approached the Government from time to time, but no decision was arrived at in the absence of a suitable working scheme and when this was attained on sound and practical lines it was easy for Government to give the long-needed powers to the Port Trust to enforce control over the infested craft entering their precincts. Thus in this instance instead of Legislature enforcing a certain procedure or custom, the correct procedure has justified the necessary enactment or rule as a beneficial one. This provision of cap and tap and constant inspections are the full answer to Brig. Covell's quest in 1928 to devise a way to check this nuisance of constant annoyance and danger to the public and the sea faring or Mercantile Community visiting the Harbour. In fact all of Col. Covell's recommendations have been practically carried out during my regime including Roof-gutters work, a pioneer work of its kind in Indian Ports with mosquito-proofing of all Port Trust tanks both on ground and overhead at considerable expense. Lastly larvicidal Gambusia fish has been introduced into sweet water static and open tanks. That instead of Bombay being one of the Worst Ports in the East for Mosquitoes, I have tried to make it one of the Safest Ports in the East. For this I have to thank all the Chairmen and Trustees of the Port with the present Chairman, Sir B. Rama Rao, I.C.S., for the kind help and the latter for permission to publish this paper.

BOMBAY,
February 13, 1943.

F. D. BANA,
M.B., M.R.C.S., D.P.H., D.T.M. & H., I.P.
Administrative Medical Officer,
Bombay Port Trust.

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4. *A Practical way of dealing with Aedes egyptus* (Stegomyia fasciata) *mosquitoes breeding in country craft,* by Dr. F. D. Bana, Indian Medical Gazette, May 1936.
5. *Mosquito Reduction in the Port Trust Docks and Bunders,* by Dr. F. D. Bana. The Port of Bombay Magazine, July 1936.
6. *Control of Stegomyia fasciata* (Aedes egyptus) *mosquitoes in Indian country craft by a mosquito-proof metal cap for drinking water receptacles,* by Dr. F. D. Bana, Indian Medical Gazette, June 1938.
7. *Yellow Fever in the East,* by F. D. Bana, The Port of Bombay Magazine, July-September 1939.

XXII.—OBSERVATIONS ON A FEW CASES OF LARVAL ECDYSIS OF THE INDIAN GLOW-WORM, *LAMPROPHORUS TENEBROSUS* WLK.

1. *A complete moult of the larva.*

On 12th March '42, a completely moulted skin was found along with a larva kept in a dish and the newly moulted larva was bright and oily with the marginal areas of the dorsal plates more brownish than yellowish. From an examination of the moult it was discovered that the thin cuticle lining the photogenic organ also was cast and the linings of the tracheal tubes were as usual left attached to the moult here and there. The linings of the mouth-parts and even the eye were cast out. The whole moult was complete excepting a small gap at the ventral portion of the thorax, through which I suppose the animal would have wriggled out.

2. *A case of moulting inside a 'closed burrow'.*

A fairly large larva, measuring about 55 mm. in length was left in a glass tray over moist earth on 1st March 1942. It was supplied regularly with snails, but the glow-worm did not feed. It was unusually very inactive. After 2 or 3 days it began to burrow into the earth and by the 9th a deep burrow was constructed against a side of the tray. The burrow was about 2 inches deep and the hollow inside was lined with a smooth surface. The animal had completely buried itself inside the burrow, which was closed with earth above. Occasionally by disturbing it I could see through the glass a bright glow inside the burrow. On 15th morning I saw the creature with a completely moulted skin attached to it. I took both the larva and its moult out and the larva of the fresh instar began to move about. The plates were very soft and delicate, but dark (dark, because ecdysis must have taken place a few hours earlier). The moulted skin had the usual linings of the tracheal tubes attached to it. These linings I could notice inside the hollow of the burrow only on the 15th. So I presume that the larva moulted on the 15th itself, but the whole skin was cast in the course of a few hours, during which time the animal had assumed the dark colour. The skin is preserved dry.

3. *A case of moulting outside the burrow.*

Another case of moulting was noticed to take place outside. In this case no special burrow was constructed for moulting. The larva having a length of about 50 mm. was placed in a glass tray over moist earth on 1st March '42. It stopped feeding and gradually developed an aversion towards snails. It began to burrow but didn't proceed further. It came out again and lay coiled up, quite exposed and inactive. The only sign of life was observed in the sudden glow of the photogenic organ when hammered by the mounted needle. It also wriggled slightly when pricked. The plates grew darker and darker and the body was considerably narrowed. On 18th March, 1942, morning at 10 a.m., it was quite inactive and I took it to be dead. It was sooty black and the body shrunken very badly. At 2 p.m., to my surprise I discovered the larva in the act of moulting. The metathoracic and abdominal exoskeleton was detached and thrown out posteriorly. The pronotum and mesonotum were still attached to the body. The newly moulted individual was bright yellowish white. At 5 p.m., no further change was observed. But the skin was becoming less and less yellow and the larva was stretching the abdomen and relaxing itself. The skin covering the 2 posterior pairs of legs were cast already and so they were white. At 5-30 p.m., the animal wriggled out vigorously. Dorsally the pronotum and mesonotum were left and ventrally the prosternum and the skin covering the forelegs alone were left. Now it looked as though the animal had a helmet. The two posterior pairs of legs were moving and pressing against each other. The head was kept outside but not so fully thrust out as during locomotion. The dorsomedian line was seen as a white streak. The posterolateral margins of the terga were diaphanous. The 8th abdominal tergum grew very dark in the middle area. The anal brush was completely retracted inside and obviously it had no part to play in ecdysis. The skin gradually became dark and on 19th morning the chitin was completely turned black as in the normal active larvae. But the 'helmet' (or pronotal piece) was not cast till the following day.

MADRAS CHRISTIAN COLLEGE,
TAMBARAM,
April 14, 1943.

J. SAMUEL RAJ,
Department of Zoology.

XXIII.—THE FLOWERING OF *STROBILANTHES CALLOSUS* NEES.

Owing to the uncertainty of the flowering cycle of *Strobilanthes callosus,* locally known as the *Karvi,* I recorded the time of the general flowering which occurred in 1928 in volume xxxiv, p. 264, of the *Journal,* in the hope that some botanist might record the next general flowering and thereby fix the length of the flowering cycle. In the note quoted above, I referred to 'forerunners' of the general flowering which showed up in August-September 1927. In 1942 'forerunners' appeared on the Western Ghats at Khandala. My son, Carl, wrote in 1942 to say that isolated bushes flowered at Abu. At present (1943) all the bushes at Khandala are full of buds, and my son wrote again recently to say that all the *Strobilanthes* at Abu are showing signs of flowering. Last week-end I noticed old plants at Mumbra, Thana District, also in bud. These records give us the flowering cycle of *Strobilanthes callosus* as *fifteen years* (1928-1943).

This is a hurried last-minute note to draw the attention of members to the general flowering of this species which will take place between September and November this year, 1943.

BOMBAY NATURAL HISTORY SOCIETY, C. McCANN.
BOMBAY,
August 5, 1943.

PROCEEDINGS OF THE ANNUAL GENERAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Society will be held at the Prince of Wales Museum, on Thursday the 19th August 1943 at 6 p.m.

AGENDA

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.
4. Such other business as may be properly brought before the Meeting.

The Honorary Secretary announced the election of the following 92 new members since the last meeting held on 22nd July 1942:—

22nd July 1942.

(1) Shri Bada Maharaj Kumar Sahib Hanwant Singh of Jodhpur; (2) Mr. G. Loucatos, Bombay; (3) Mr. R. D. Leakey, Bombay; (4) Mr. A. Raptakos, Bombay; (5) Mr. Francis Low (Jr.), Bombay; (6) Major R. H. Beamish, No. 12 Advance Base P.O., India; (7) Mr. James A. Hall, M. E. Force; (8) Mr. R. F. Twist, Assam; (9) Mr. S. W. C. Dunlop, I.C.S., Bezwada; (10) Mr. R. S. Symons, I.C.S., New Delhi; (11) Professor of Zoology, Osmania University, Secunderabad, Deccan; (12) Mr. W. F. Penberthy, Calcutta; (13) The Principal, Dunger College, Bikaner; (14) The Honorary Secretary, Ahmednagar Club, Ahmednagar; (15) D. S. Vala Bawabhai, Talukdar of Babra, Kathiawar; (16) Dr. G. Heslop Harrison, Bombay; (17) Major J. W. Rawlins, New Delhi; (18) Major Peter Hook, New Delhi; (19) Lt.-Col. B. T. Phillips, I.A. (Retd.) Srinagar; (20) The Director of Industries, Bombay; (21) Capt. Aubrey Buxton, Bombay; (22) Lt.-Col. J. H. Blyth, I.A., New Delhi; (23) The Mother Superior, Oxford Mission, Behala, Calcutta; (24) Major G. M. Holland, Bombay; (25) Mr. W. T. Loke, Bombay; (26) Mr. E. K. Hari Krishna, Quetta; (27) Mr. H. J. Mitchell, B.F.S., Simla; (28) Mr. A. S. Laing, Bombay; (29) Mrs. Desiree Proud, Simla Hills (30) Mr. J. Walker, I. F. S., New Delhi; (31) W. Olmstead, Esq., New Delhi; (32) Mr. Brian Hocking, I.A.O.C., Cawnpore; (33) Mr. H. T. Mackett, Delhi; (34) Dr. V. N. Likhite, D.SC., Mehsana, North Gujerat; (35) Lt. J. R. Armitage, Bombay; (36) Mr. K. Karunakaran Nayar, Trivandrum; (37) The Principal, Sikh National College, Lahore; (38) Mr. A. G. A. Beyts, Chitral; (39) Mr. W. L. French, Army Base P.O.; (40) Major F. J. S. Turner, Colombo; (41) Mr. C. L. Hamilton, Calcutta.

1st January 1943.

(1) Mr. J. R. Scott, Bombay; (2) Mr. H .B. Hayes, Bombay; (3) Mr. G. H. Jollye, Middle East Force; (4) Mr. Owen Martin, Bombay; (5) Sgt. J. D. Romer, Bombay; (6) Mr. Eden Showers, Assam; (7) H. H. The Raja of Pudukkottai; (8) Mr. A. R. Haseler, Simla; (9) H. H. Maharaja Shri Brijendra Sawai Brijendra Singh Sahib Bahadur, Maharaja of Bharatpur; (10) Dr. V. Prabhakar Rao, M.A., D.SC., Bombay; (11) Dr. C. C. John, M.A., D.SC., Trivandrum; (12) D. Stewart Brown, Bombay; (13) The Director, Drug Research Institute, Jammu Tawi; (14) Major J. N. Reeve, R.A., Bombay; (15) Major I. A. Pace, Bombay; (16) Sgt. A. F. Armstead, Dinapore; (17) Miss M. F. Barber, Mudis P.O.; (18) The P.R.I. No. 26, Prisoner of War Camp, Yol, Punjab; (19) Mr. J. T. D. Savary, Sind; (20) Capt. A. D. Hunter, No. 6,

Advance Base P.O., India; (21) Mr. Rufus H. Le-Fevre, U.S.A.; (22) Lt.-Col. E. L. Farley, C.B.E., M.C., Mhow; (23) Mr. S. N. Elijah, Belgaum; (24) Dr. P. Dharma Pal, L.M.&.S., Mudis P.O.; (25) Mr. E. H. Clarke, Jullundur; (26) Major R. Holmes, M.B.E., Bushire; (27) Major T. D. Mills, Dinapore; (28) Mr. M. R. Coghlan, Travancore; (29) Sgt. P. V. Hicks, A.B.P.O. No. 21, India; (30) The President, Mess Committee, Chindwara, C.P.; (31) Major-General H. J. Manockjee Cursetjee, Bombay; (32) Mr. W. J. Cullen, Karachi; (33) Lt. G. L. Randall, R.E., Lahore; (34) The Instructor, Eastern States Forest School, Champua P.O.; (35) Mr. M. J. P. Cruttwell, Mussoorie; (36) Capt. C. R. Stoner, No. 14, Advance Base P.O.; (37) Mr. N. B. Banarjee, Meerut; (38) Major F. R. McL. Moodie, I.E., Roorkee; (39) Lt.-Col. D. C. MacLeod, New Delhi; (40) Mr. James A. Hislop, Bombay; (41) Rev. Dr. J. B. Freeman, Chingleput; (42) Capt. C. Rea, Kakul; (43) Major J. D. Olivier, R.A., Campbellpore, Punjab; (44) Mrs. K. I. Barlow, Peshawar; (45) Capt. Ph. E. Milon, Egypt; (46) Major L. D. J. Turnbull, Calcutta; (47) F/O T. R. Garnett, Indian Command; (48) Mr. Alfred S. Paines, England; (49) Lt. P. W. Hinde, Bombay; (50) Lt. P. I. R. Maclaren, R.I.A.S.C., Rawalpindi; (51) Mr. John Dewar, Jalpaiguri.

OFFICE BEARERS—1943.

The following gentlemen were elected to serve on the Managing Committee:—

President.—H. E. The Right Hon'ble Sir John Colville, G.C.I.E., T.D.

Vice-Presidents.—Rev. Father J. F. Caius, S.J., F.L.S. and Rt. Rev. R. D. Acland, M.A.

Executive Committee (Bombay).—Mr. Humayun Abdullaly; Mr. Salim Ali; Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, C.B.E., M.L.A., J.P.; Mr. R. E. Hawkins; Mr. D. G. Hill, F.R.G.S., J.P.; Dr. M. Sharif, D.SC., Ph.D., F.N.I.; Lt.-Col. S. S. Sokhey, I.M.S.; Mr. F. Wadia; Mr. T. E. Savaides (*Hon. Treasurer*); Revd. Fr. J. F. Caius, S.J., F.L.S. (*Hon. Secretary*).

Advisory Committee.—Dr. N. L. Bor, M.A., D.SC., F.L.S., I.F.S., Assam; Lt.-Col. R. W. Burton, I.A. (Retd.), Bangalore; Mr. M. B. Dalal, Bombay; Mr. C. H. Donald, F.Z.S., Dharmsala; Dr. F. H. Gravely, D.SC., Kodaikanal; Mr. C. M. Inglis, B.E.M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian-Adams, F.Z.S., I.A., Bangalore; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Simla; Mr. J. H. Williams, Coimbatore.

Staff.—Mr. S. H. Prater, O.B.E., M.L.A., J.P., C.M.Z.S. (*Curator*) and Mr. C. McCann, F.L.S. (*Assistant Curator*); A. F. Fernandes (*Head Clerk*).

Proceedings concluded with a vote of thanks to the Chair.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER, 1942.

ADMINISTRATION.

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—Rev. Fr. J. F. Caius, S.J., F.L.S., and Rt. Rev. R. D. Acland, M.A.

Executive Committee (Bombay).—Mr. Humayun Abdulali; Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, C.B.E., M.L.A., J.P.; Mr. R. E. Hawkins; Mr. D. G. Hill, F.R.G.S., J.P.; Dr. M. Sharif, D.SC., Ph.D., F.L.S.; Lt.-Col. S. S. Sokhey, I.M.S.; Mr. F. Wadia; Mr. T. E. Savaides (*Honorary Treasurer*); Rev. Fr. J. F. Caius, S.J., F.L.S. (*Honorary Secretary*).

Advisory Committee.—Mr. Salim Ali, Dr. N. L. Bor, M.A., D.SC., F.L.S., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A. (Retd.), Bangalore; Mr. C. H. Donald, F.Z.S., Dharmsala; Dr. F. H. Gravely, D.SC., Kodaikanal; Mr. C. M, Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Lt.-Col. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian-Adams, I.A., F.Z.S., Bangalore; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Simla; Mr. J. H. Williams, Coimbatore.

Staff.—Mr. S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); Mr. C. McCann, F.L.S. (*Asst. Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1942.

THE SOCIETY'S JOURNAL.

Three numbers of the forty-third Volume of the *Journal* were published during the year.

MAMMALS.

Papers on Mammals include Part I of Mr. Pocock's study of the larger Indian deer. Scientific literature on the species of deer inhabiting British India is limited mainly to descriptions of their antlers and other external features. The present contribution provides detailed descriptions of the skulls, indicating resemblances and differences in cranial characters. Four Elapine species are dealt with. Two of them, the Kashmir *Barasingh* or Hangul and the Shou are known to occur within our limits. Wallich's Deer is found in Tibet. The fourth species, Przewalski's Deer (*Przewalskium albirostris*) is included in the Indian list on the evidence of a head-skin and skull obtained in the Darjeeling Bazar. A key summarising distinctions between the 4 species will help both students and laymen to identify these little known deer by their external and cranial characters.

Dr. W. C. Osman Hill, Professor of Anatomy at the Colombo Medical College, describes a new race of Slender Loris under the name *Loris tardigradus nycticeboides* from an adult male and female and two young obtained from the Horton Plains (alt. 6,000 ft.) in Central Ceylon. In a second paper, Dr. Hill deals with the Tocque Macacques (*Macaca sinica*) of Ceylon. Pocock in his recent volume on Mammalia distinguishes two races—the typical form, *M. s. sinica,* found in the dry zone of the lowlands and a hill race *M. s. aurifrons,* inhabiting the central hill ranges and the lower jungles of the wet zone. A study of Tocque monkeys collected from the uppermost levels of the Central Range led to the conclusion that they represent a distinctive race to which Dr. Hill assigns the name *M. s. opisthomelas.* This, the real highland race, occupies the uppermost of the three geographical terraces composing the land structure of the island, while *M. s. aurifrons,* from the lower or intermediate levels, is an annectant race between the highland and the lowland forms.

BIRDS.

Mr. Salim Ali's paper on the Birds of Mysore embodies the results of a survey of the State carried out conjointly by the Society and the American Museum of Natural History, New York. A survey of Mysore was especially necessary to complete the data obtained as a result of surveys in the Eastern Ghats and Southern India, which indicate that the intervening territory of Mysore is a meeting ground of the distinctive racial forms inhabiting the eastern and western parts of the Peninsula. Our thanks are due to the Mysore Darbar for financial help and other facilities given to the Society in carrying out the Survey. In the introduction to his report Mr. Ali discusses the Physiography and Meteorology of

Mysore, associating his study of environmental factors with the distribution of species. An attempt is made to fix provisional habitat types by distinguishing species which inhabit dense evergreen forest, those found in deciduous forest and those confined mainly to an intermediate mixed biotope. These ecological studies are a step to the better understanding of factors underlying distribution of species and the evolution of racial forms. In India they offer naturalists a wide field of neglected exploration. Mr. Ali's paper shows the lines upon which this work can be done. The survey was also instrumental in settling a number of questions about the racial status, plumage, breeding, and movements of a number of species. We must thank Mr. Ali for his interesting report and Mr. Whistler for his taxonomical study of the collections obtained by the Survey.

A useful supplement to previous literature on Central Indian Birds is a paper on the Birds of Berar by Mrs. M. D. Wright. The birds of the higher levels of the Karen Hills and Karenni, Burma, by Messrs. Smith, Garthwaite and Smythies is the first connected account of the birds of this area. Readers of our *Journal* will be glad to hear that the authors have been able to bring away from ill-fated Rangoon most of the blocks and original paintings used for their fine work on the Birds of Burma. From the many enquiries we have had for this book we may assure them that a second edition is awaited by many.

Additional notes on the Birds of Northern Baluchistan, supplementing the late Dr. Ticehurst's papers on the Avifauna of the country were written by Major-General A. F. P. Christison. The paper deals with new records and settles questions relative to a number of species of which the racial status has been in doubt. Obviously, a great deal of exploratory work remains to be done in Baluchistan, a promising field for Ornithologists stationed in the country.

Among the local lists published during the year is a paper on the Birds of Londa, North Canara, by Walter Koeltz in which reference is made to a large number of new races of birds originally described by the author in the Proceedings of the Biological Society of Washington. Mr. Whistler's study of and comments on these new races, published as an addendum to Mr. Koeltz's paper, emphasizes the need for greater restraint in establishing new races without adequate material for comparative study. This from the nature of his deductions, Mr. Koeltz obviously did not have, the majority of new races described by him cannot stand.

Mr. Humayun Abdulali gives an account of a second visit to the Vengurla Rocks—off the Ratnagiri Coast—the breeding grounds of various terns and of edible-nest swifts. To the local breeding records of *Sterna bergii, S. anaetheta* and *S. repressa* we may now add *S. dougalli* and *S. fuscata*—the Sooty tern, whose nearest hitherto known breeding place was the Laccadives. The party spent much of the time investigating the breeding cave of the swifts. Some 5,000 of them swarmed home to roost after dark and could be seen by torchlight clinging close-packed to the rock face and to their nests, looking extraordinarily like bats. Many of the nests appeared to have been replastered with saliva, suggesting that they may be used more than once. All were empty. Breeding probably takes place later in the year when the oncoming monsoon makes this forbidding, wave-beaten islet wholly inaccessible.

An interesting and well illustrated account of the nesting habits of the Indian Courser was contributed by Mr. W: W. A. Phillips.

Mr. E. H. N. Lowther writes his notes on Indian Birds with all that insight and sympathy which comes from many hours of patient bird-watching. His subject is Indian Hornbills, about whose unique nesting habits much that is precise yet remains to be known. Does the imprisoned female leave the nest before her eggs are hatched? Habits may vary with different species. In the instance of our Common Grey Hornbill (*I. birostris*) Mr. Lowther's answer based on observations made at three different nests is definitely—no. Again, in the case of this species, the bulk of evidence shows that the female alone builds the enclosing wall of the nest. Analysis of fragments of the wall, sent by the author to the Society, reveal that it is built up of earth and animal excreta mixed together with pieces of bark, hay, etc., collected from the nest hollow. Food for the imprisoned female is carried by the male in his gullet and feeding is effected by regurgitation. The female Grey Hornbill does not leave the nest till the young are about a fortnight old, not infrequently when they are about ready to fly. She lets herself out unaided by the male, breaking down the nest wall with hammer strokes of her bill. The wall may or may not be rebuilt to provide continued protection for the young. Whether the parents rebuild the wall or whether, as in the case of certain African species, it is rebuilt by the young is a question which remains to be answered. Mr. Lowther's informative notes are, as always, illustrated with his fine photographs.

Excellent also are Col. Bates' pictures of birds taken during a brief holiday in the great deodar forests of the Kazinag range. His notes and photos were a feature of the April number. Readers of our *Journal* have reason to be grateful both to Mr. Lowther and to Col. Bates, whose pictures and writings add so much to the attractiveness of its pages. At no small sacrifice they maintain the fine tradition of voluntary effort upon which the repute of this Journal has been built.

REPTILES AND FISHES.

We were able to publish only one part of Dr. Hora's serial on the Game Fishes of India, as high costs of printing impose a more rigid limitation on the number of coloured plates included in each issue. In his six previous articles Dr. Hora described various species of 'Mahseer' from the rivers of North India, he now turns to the Mahseer of the Deccan from whence a confusing number of species have been described. We take this opportunity of offering our congratulations to Dr. Hora on his appointment as Director of Fisheries, Bengal. The Bengal Government is fortunate in securing the services of a man of his knowledge and ability. It is hoped that Dr. Hora will have time to continue his scientific work and that Indian Ichthyology will not be wholly deprived of the services of one who is making so great a contribution to its progress. The fishes of the waterways of the Deccan also form the subject of a report by Capt. Fraser, who collected some 2,800 specimens in Poona and its environs. Dr. Fraser's general account of the various localities in which fishes were collected and the species obtained in each is followed by his notes on the ecology and bionomics of certain forms. His collection was studied by Dr. Hora and K. S. Misra who give a list of Poona fishes, with their Hindi names, and their distribution. Of special interest is the discovery within this limited area in India of certain species hitherto known to occur only in Burma, Siam and Malaya, suggesting the Malayan affinities of the Fauna of this part of the Western Ghats. The thanks of the Society are due to Capt. Fraser for the work he has done, the greater part of his fine collection is now in our Museum. Yet another student of the Fish Fauna of Poona is that enthusiastic fisherman, Dr. M. Suter who contributes his observations on the breeding coloration of *Barbus kolus*. A handsome breeding livery is customarily donned by males of this group of fishes, but with this carp it is the female who attracts attention to herself with the gaiety of her bridal apparel. The coloured plate accompanying the article is based on an original coloured sketch by Dr. Suter. We thank him for contributing towards the cost of its reproduction and for the many ways in which he has helped Dr. Hora in his study of the fish fauna of his neighbourhood. Dr. Hamid Khan's paper on the 'Spawning of Carp and their Spawning grounds in the Punjab' is a contribution to better knowledge of this group of Indian freshwater fishes. The supply of these fine food fishes, economically the most important in our rivers, is at present dependent entirely on natural spawning. As such, improvement of our inland fisheries depends substantially on the measures taken for their protection from wholesale destruction during the breeding season and upon the facilities which can be given them to reach their natural spawning grounds. Neglect of these provisions has implied and continues to imply neglect of an important and valuable source of food supply to the people of the country. The series of articles on the Game Fishes of India, written mainly from the scientific aspect, were directed to provide, in the first instance, accurate information about their status and distribution. But knowledge of fish is one thing and knowledge of fishing is another. We feel therefore that no better pendant to Dr. Hora's work in our *Journal* could be provided than Mr. A. St. J. Macdonald's serial on 'Circumventing the Mahseer and other Sporting Fish in India and Burma'. Mr. Macdonald writes for the young angler and for those of lesser experience, giving them generously all that hard won knowledge of fish and fishing which leads to the mastery of the gentle art and to the making of a good fisherman. Many fish have been taken and much water has flowed from the rivers to the sea since Thomas wrote his classic 'Rod in India'. To the sum of what was then written Mr. Macdonald adds much that is new both in practice and precept. When Macdonald's serial finally appears in book form it will become the new *vade mecum* for anglers in India.

INSECTS.

Papers on insects include parts IX and X of Mr. Sevastopulo's study of the Early Stages of the Indian Lepidoptera, and a paper by Mr. M. C. Cherian on *Goniozus indicus,* a natural enemy of the sugarcane White Moth borer (*Scirophaga rhodoproctalis*).

BOTANY.

Parts X, XI and XII of the serial on 'Beautiful Indian Climbers and Shrubs' by Dr. N. L. Bor and M. B. Raizada, published during the year, deal with the *Solanaceae* and the *Verbenaceae* which include so many attractive garden plants. Father Caius continued his serial on Indian medicinal and poisonous plants; the August number of the *Journal* contained his paper on the Medicinal Mallowworts of India. As with all the *Malvaceae* none of these plants are poisonous, but many are well known for their emollient and tonic properties. Parts IX and X of Mr. M. Sayeedud-Din's serial on Common Indian Herbs were issued. Mr. McCann's paper on Indian Duckweeds (*Lemnaceae*) is an important contribution to the study of a little known order of plants, much neglected by Botanists. The author clarifies the confused status of Indian species and records fresh observations made over many years both in the field and the herbarium. Dr. Kundu's Revision of the Indian species of *Hodgsonia* and *Trichosanthes* revises the classification and nomenclature of the two genera, and assembles in one paper the large number of species discovered and described by various workers in numerous scattered publications. Such revision of most of the families of Indian plants described in Hooker's 'Flora of British India' is long overdue. Appreciative reference must also be made to Professor D'Almeida's intensive study of Indian marsh and aquatic plants which adds much new information to what is recorded in the various Floras. Mr. Abdul Hameed's paper on the Liverworts of the Murree Hills introduces laymen to an obscure but none-the-less important division of the Plant Kingdom. His paper contains notes and illustrations of some 23 different species from the Murree Hills.

GENERAL.

More reminiscences of happy hunting days on the banks of the Narbudda come to us from the pen of Col. Burton, whose articles never fail to recapture the charm of leisurely days in field and forest given now to few to enjoy. Mr. McCann's 'Busman's Holiday in the Abu Hills' is a miscellany of interesting notes on plants, animals and birds, written by one whose sole absorption at work or at play is the world of Nature.

We cannot conclude this review of the papers published during the year without expressing our thanks to all those who contributed to the Miscellaneous Notes which have always been a feature of our Journal and a source of special interest to most of its readers. Despite increasingly rigorous conditions imposed by the War, we have endeavoured to maintain the standard of the Society's Journal, but the Council of the Society feels that we cannot altogether escape the fate that has befallen so many kindred publications and that a stricter limit must be placed to the number of its pages and illustrations. This naturally raises the difficulty of finding space for numerous papers received, and of maintaining unbroken the sequence of various current serials, but we are certain that members will bear with us. Their support and cooperation will help the Society to tide over these critical times, and to continue its work, till happier days restore to the full the measure and scope of its many activities.

PUBLICATIONS.

The first edition of Salim Ali's Book of Indian Birds published in 1941 was sold out almost within the year. A second revised and enlarged edition containing additional plates and descriptive matter is now in the press and will be available shortly. There is a demand for well written and well illustrated books on Indian Natural History. So far, such literature has been limited mainly to technical works or costly books unintelligible to—or beyond the reach of the public. The Book of Indian Birds has served its precise purpose—readable, attractive and inexpensive, it has appealed to a wide public. Its immediate success has encouraged the Society to consider the publication of companion volumes in the same style and format. The Book of Indian Animals is now in course of preparation by Mr. Prater, whose serial on the Wild Animals of the Indian Empire was published in the *Journal* some years ago. Mr. Prater's book will deal with the commoner Mammals of India. It will be well illustrated in colour, and black and white, and will include descriptive accounts and general chapters in the manner of the Book of Indian Birds.

Another book now in preparation is a work on the Poisonous Land Snakes of India. It is many years since the fourth edition of the Poisonous Terrestrial Snakes of India by Col. Wall went out of print. Part I of the new work has been written by Dr. Malcolm Smith, author of the new edition on Indian Reptiles in the Fauna of British India series. Parts II and III dealing with snake venoms and the treatment of snake bite was to have been written by Dr. Burgess Barnett, whose researches into the application of snake venoms in surgery and medicine have attracted considerable attention. On the outbreak of War with Japan Dr. Barnett, we understand, offered his services to the Military and we regret that we have not heard from him since. The Society has however been fortunate in securing the help of Lt.-Col. Sokhey, Director of the Haffkine Institute, Bombay, who has undertaken the preparation of Parts II and III. The book will provide an up to date and authoritative work on Indian Poisonous Snakes and the treatment of snake bite.

The Nature Calendars issued annually by the Society have been an outstanding success. We received numerous letters congratulating us on the excellence of the Calendar published in 1942 and were, unfortunately, unable to meet the unexpectedly large demand. Our special thanks are due to Col. Bates, to Mr. Lowther and others whose fine photos contributed so much to the attractiveness of these Calendars, which are a welcome source of much needed revenue to the Society.

REVENUE ACCOUNT.

Our total revenue amounted to Rs. 38,665-3-7 as compared with Rs. 24,887-12-5 in the previous year. The increase was mainly due to receipts from sales of publications. Receipts from subscriptions amounted to Rs. 16,622-5-5 as against Rs. 16,101-6-10 in the previous year. The loss of Malaya and Burma where we had many members, and loss of contact with so many now serving in various fronts have considerably depleted this main source of constant revenue. On the other hand while expenditure on salaries and staff has been maintained at pre-war level, we are faced with increasing costs in almost every direction. It is confidently hoped that every effort will be made by the members to ensure the continuity of their support and the continuity of the Society's work.

DONATIONS.

The Council of the Society, on behalf of its members wish to acknowledge with gratitude the handsome donations of Rs. 5,000 each, made by their Highnesses the Maharao of Kutch and the Maharaja of Bikaner both of whom, on their recent accession, honoured the Society by becoming its Vice-Patrons. Our thanks are also due to all those who generously contributed to the special fund created to meet the increased cost of the *Journal*. The following is a list of donations received:—

	Rs.	A.	P.
Trustees of the late Mr. F. V. Evans ...	1,189	10	5
Janjira State	250	0	0
Morvi State	500	0	0
Junagadh State	100	0	0
Mayurbhanj State	1,000	0	0
Total ...	3,039	10	5

MEMBERSHIP.

68 new members joined as against 48 in the previous year. 32 resigned as against 24 in 1941.

After deductions made owing to death, or non-payment of subscriptions the total membership inclusive of Life Membership was 974 as against 992 in the previous year.

OBITUARY.

The death of H.H. Shri Kengarji Maharao of Kutch was a sad loss to the Society which for many years enjoyed his patronage and support. An obituary notice in the *Journal* of the Society pays tribute to the memory of His Highness, a Patron and a friend of the Society, a sportsman and a great gentleman,

ACKNOWLEDGMENTS.

We offer our grateful thanks to Mr. W. S. Millard who since he retired from the Honorary Secretaryship, some 25 years ago, has continued to look after the Society's affairs in London. His constant and willing help has meant much to us.

STAFF.

The Committee once again wishes to record its appreciation of the services of the Curator and staff whose loyal and devoted service is helping the Society to carry on in these critical times.

J. F. CAIUS,
Honorary Secretary.

10th *July* 1943

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER, 1942.

LIABILITIES		Rs A P	Rs A P
Life Membership fees :			55.125 0 0
Donations for specific purposes unexpended :			
Ornithological Survey			1,448 13 0
Donations from States for 1943 expenses.			12,350 0 0
Sundry Creditors :			
Mr. E. C. Stuart Baker: Account Game Books		817 3 8	
Brig. W. H. Evans: Account Butterfly Books		528 2 2	
For Expenses (Audit Fee)		250 0 0	
The Diocesan Press, Madras, Journal Account		2,200 0 0	3,795 5 10
Donation from H.E.H. the Nizam for Expenses			5,000 0 0
Surplus Assets :			
Balance as per last Balance Sheet ...		19,234 0 11	
Add.—Surplus on Revenue Account ...	4,586 7 8		
Less—Fluctuation in the value of Securities.	309 12 7		
		4,276 11 1	23,510 12 0
Total ...			1,01,229 14 10

ASSETS	R A P	Rs A P
Investments—At holding value or Market value whichever is lower :—		
Rs. 30,000 3½% Loan 1947-50	30,675 0 0	
,, 15,000 5% do. 1945-55	15,000 0 0	
,, 10,000 3% do. 1951-54	9,800 0 0	
,, 14,000 4% Bombay Port Trust Bonds.	10,780 0 0	
,, 15,000 4% Bombay Improvement Trust Bonds	11,400 0 0	
,, 5,000 3½% Pro Note 1854-55 (out of donation received from H. E.H, the Nizam)	4,687 8 0	82,342 8 0
Rs. 89,000 (Market value at 31st Dec. 1942 Rs. 93,440).		
Cash—		
With National Bank of India, Ltd., Bombay, (inclusive of Rs. 2-11-5 out of donation received from H.E.H. the Nizam.)	12,274 6 0	
With National Bank of India, Ltd., London, £1007-8-10 at 1/6	1,339 3 6	
On hand	250 0 0	13,863 9 6
Sundry Debtors		724 8 0
Advances to Staff		720 9 0
Expenditure on Book on Climbing Shrubs	1,688 12 4	
Expenditure on Book on Poisonous Terrestrial Snakes	75 0 0	1,763 12 4
Furniture :		
As per last Balance Sheet	1,840 0 0	
Less—Depreciation	25 0 0	1,815 0 0
Total ...		1,01,229 14 10

Note.—A stock of 22,100 old Journals, and the valuable research collections and Library of 2,710 volumes have not been taken into account on the Assets side of the Balance Sheet.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.

In our opinion, such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and explanations given to us.

BOMBAY, *1943.*

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) T E. SAVAIDES,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1942.

Dr.	Rs A P	Rs A P		Rs A P	Rs A P *Cr.*
To Salaries	19,369 0 0		By Subscriptions	16,622 5 5	
,, Society's Contribution to Staff Provident Fund	1,495 0 0		,, Entrance Fees	660 0 0	
,, General Charges	377 3 8		,, *Sales of :*		
,, Rent	2,436 0 0		Old Journals	926 6 3	
,, Stationery and Printing	388 14 0		Game Books, Vols. I, II & III ...	332 3 8	
,, Postage	696 7 9		Society's Publications	1,392 13 2	
,, Library	232 11 11		Calendars	1,790 2 3	
,, Audit Fee	250 0 0		,, Book of Indian Birds	12,392 5 3	
,, Fire and War Risk Insurance	895 9 0		,, Butterfly Books	223 1 4	
,, Depreciation on Furniture	25 0 0		,, Interest on Investments	3,454 11 0	
,, Cost of Printing Journals	7,912 13 7		,, Profit on outside works	871 3 3	
		34,078 11 11			38,665 3 7
,, Surplus carried to Balance Sheet ...		4,586 7 8			
Total ...		38,665 3 7	Total ...		38,665 3 7

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1942.

	Rs A P	Rs A P		Rs A P	Rs A P
To Book on Climbing Shrubs:					
Expenditure to 31st December, 1941 ...	628 1 4				
Expenditure during the year to 31st December, 1942	1,060 11 0	1,688 12 4	By Balance carried to Balance Sheet ...		1,688 12 4
,, Book on birds by Sâlim A. Ali:					
Balance as per last Balance Sheet ...	747 3 7				
Profit carried to Revenue Account ...	12,392 5 3	13,139 8 10	,, By Sale Proceeds of Indian Bird books		13,139 8 10
,, Book on Poisonous Terrestrial Snakes...		75 0 0	,, Balance carried to Balance Sheet ...		75 0 0
,, Printing Charges of Calendars ...	2,562 1 3				
Profit carried to Revenue Account ...	1,790 2 3	4,352 3 6	,, Sale Proceeds of Calendars		4,352 3 6

Dr Cr.

ORNITHOLOGICAL SURVEY ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1942.

	Rs A P	Rs A P		Rs A P	Rs A P
Ornithological Survey					
To Balance carried to Balance Sheet ...	1,448 13 0	1,488 13 0	By Unexpended balance as per last Balance Sheet		1,488 13 0
Total ...		1,488 13 0	Total ...		1,488 13 0

BOMBAY, *1943.*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) T. E. SAVAIDES,
Honorary Treasurer.

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EDITED BY

REV. J. F. CAIUS, S.J., F.L.S.

S. H. PRATER, O.B.E., M.L.A., C.M.Z.S., AND C. McCANN, F.L.S.

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Ordinary Members pay an entrance fee of Rs. 10 and an annual subscription of Rs. 25.

The subscription of members elected in October, November and December covers the period from the date of their election up till the end of the following year.

MEMBERS RESIDING OUTSIDE INDIA.

The terms are the same for members living outside India. Such members should pay their subscriptions by means of orders on their Bankers to pay the amount of the subscription, plus postage—in all Rs. 26-8-0—to the Society in Bombay on the 1st January in each year. If this cannot be done, then the sum of £2-0-6 should be paid annually to the Society's London Bankers—The National Bank of India, Bishopsgate Street, London, E.C.

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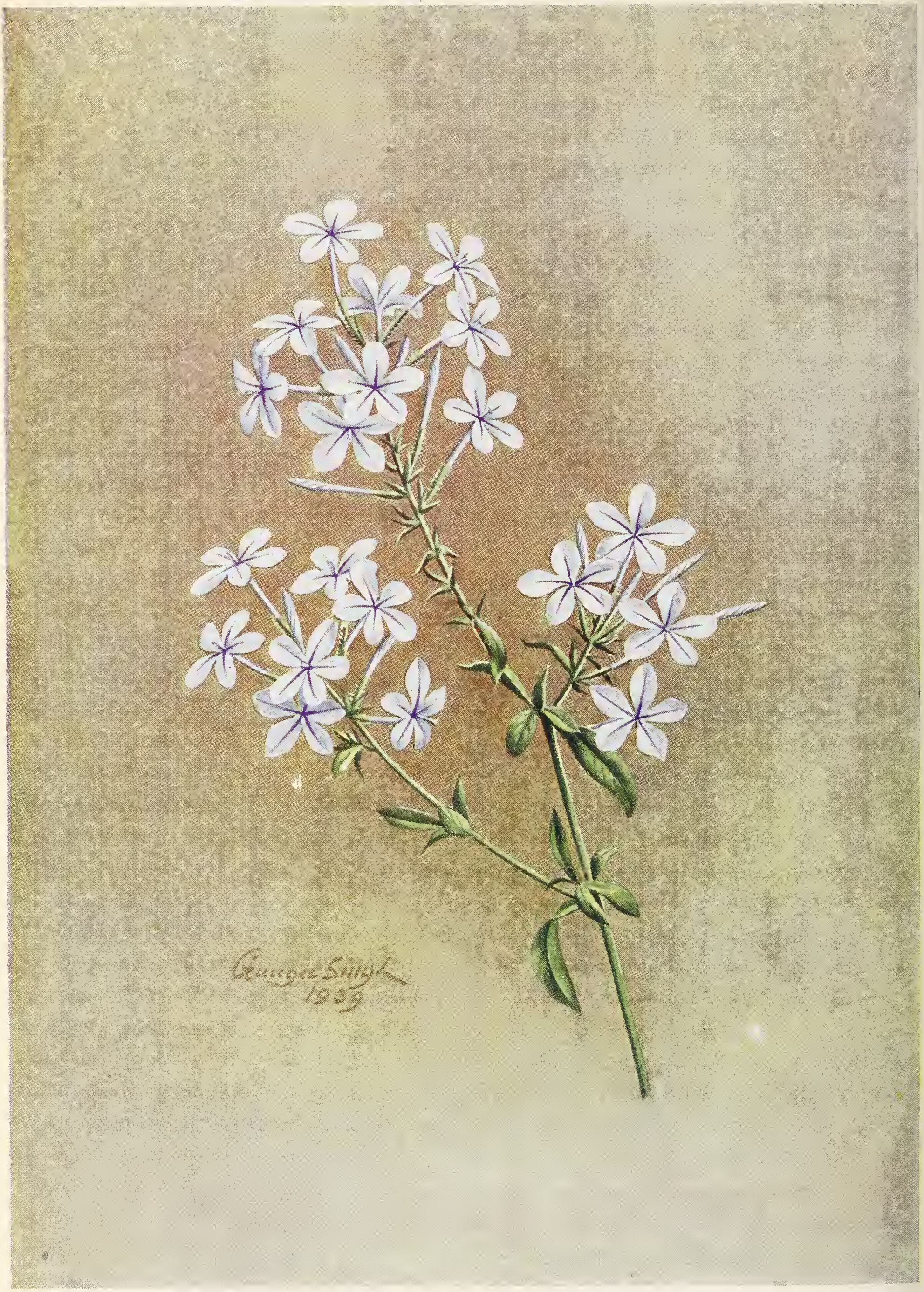


The Cape Plumbago
PLUMBAGO CAPENSIS Thunb.
Size 2/3.

JOURNAL

OF THE

Bombay Natural History Society.

1943. Vol. XLIV No. 2.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. Bor, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

M. B. Raizada, M.SC.,

Assistant Forest Botanist,

Forest Research Institute, Dehra Dun.

Part XV

(*Continued from Vol.* xliv, *No.* 1 (1943), *p.* 77).

(*With* 1 *coloured and* 2 *black and white plates and* 2 *text-figures*).

Plumbago Linn.

The name *Plumbago* seems to be derived from the Latin *plumbum,* meaning lead. Some authors assert that the name was given to the genus on account of the lead-coloured flowers of some species. There is, however, another explanation. Pliny and Dioscorides, who wrote on medicinal plants in ancient times, prescribe decoctions of the plant *Plumbago europaea* as treatment for an affection of the eyes known in Latin as *plumbum.* The sap of the roots is also said to leave lead-grey coloured flecks if applied to the skin.

MAR 25 '44

The family *Plumbaginaceae*, to which our genus belongs, contains besides *Plumbago*, several genera which are valued in temperate countries for their pretty flowers. *Limonium* and *Statice* may be mentioned in this connection, both of which are represented by many species in the gardens of America and Europe.

The family contains for the most part perennial shrubs or half-shrubs and also rosette plants. The leaves are entire, rarely lobed, and characterised by the possession of many-celled glands which secrete water, slime or carbonate. The inflorescence may be simple or compound with the flowers arranged in heads or racemes. Flowers gamopetalous; corolla tubular with a spreading, 5-lobed limb. The calyx is gamosepalous, shortly 5-lobed and furrowed between the lobes. Stamens 5. The ovary consists of 5 carpels of which one only has a pendulous ovule on a basal funicle.

The genus *Plumbago*, of which several species are commonly cultivated in the gardens of India, comprises shrubs and under-shrubs sometimes scandent. The leaves are alternate, entire, with the petiole sometimes auricled at the base. The flowers are arranged in terminal racemes. The corolla tube is long and slender and is divided at the top into 5 spreading lobes. The colour of the corolla may be white, rose-coloured or blue. The stamens are five in number opposite to the petals, and are free with oblong, dorsifixed anthers. Ovary superior, 1-celled, 5-angled, and contains one ovule. The fruit is a capsule.

The flowers are protogynous, that is, the stigmas are thrust forth from the corolla tube well above the maturing anthers. This is a device to ensure cross fertilisation which in the case of *Plumbago* seems to be accomplished by flying insects. Unwelcome visitors such as ants, are prevented from reaching the corolla by the rows of viscid glands found on the calyx tube.

A bitter substance known as plumbagin is contained in the tissues of the species of this genus. It is said to be identical with ophioxylin, which occurs in *Rauwolfia serpentina*, a species of Apocynaceae, which is well known in the Hindu pharmacopoeia. Plumbagin has vesicant properties, and is said to be widely used in tropical countries as an abortifacient. As the juice causes large and painful blisters, its use for this purpose seems to be not unaccompanied by danger. More legitimate uses for the drug are in its application to stimulate stagnant ulcers, as a counterirritant for toothache, as a purgative and as a palliative for rheumatism, glandular swellings and the like.

This genus affords a good example of dispersal through the viscid hairs on the calyx. The calyx is persistent and contains the 1-seeded capsule. Any animal which brushes against a *Plumbago* bush is certain to carry away ripe fruits, transporting the seed to great distances.

KEY TO THE SPECIES.

Flowers white or blue.	
Calyx wholly covered with stalked glands	... *P. zeylanica.*
Calyx glandular in the upper part only	... *P. capensis.*
Flowers red	... *P. rosea.*

Plumbago zeylanica Linn.

The Ceylon Leadwort.

(*zeylanicus* is a Latin adjective, meaning of Ceylon, and refers to Southern India or Ceylon as the country of origin of the species).

Description.—A shrub or semi-scandent shrub with diffuse branches and ribbed stems covered with a scurfy, glandular exudation. Leaves alternate, petiolate; petiole up to 1 in. long, slightly auriculate at the base; blade up to 3 in. long by 2 in. broad, ovate, acute or obtuse, suddenly narrowed into a cuneate base, dark green above, rather pale below, glabrous; margin entire.

Flowers arranged in terminal simple or branched racemes up to 12 in. long; rhachis very glandular and covered with a viscid exudation. Flowers seated on a very short pedicel supported by a bract and two bracteoles. Calyx .5-.6 in. long, conspicuously 5-ribbed, each rib ending in an acute clayx-lobe. The ribs are covered all over with numerous stalked glands with spherical tips, very viscid. Corolla gamopetalous, white; tube slender .75 in. long, ending in 5 ovate lobes .3 in. long. Stamens 5; filaments green, as long as the tube slightly dilated at the base. Ovary shortly stipitate; style long, divided at the tip into 5 stigmas. Fruit a capsule contained in the viscid, glandular, persistent calyx.

Flowers and Fruits.—Cold season.

Distribution.—Tropics of Asia and Africa, and east to Australia and Hawaii. Wild and extensively cultivated throughout India.

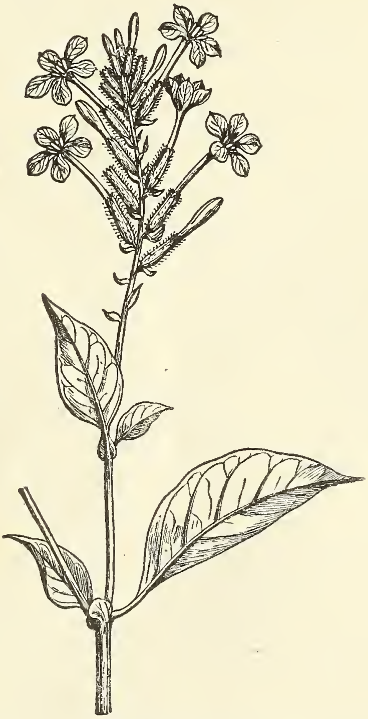


Fig. 1.—*Plumbago zeylanica* Linn. × ½.

Gardening.—A rambling, sub-scandent, untidy shrub with star-like, white flowers. It seeds abundantly but is usually propagated by suckers. It is capable of much improvement by judicious pruning and training.

Medicinal uses.—The medicinal properties of the root of this plant are well known to Indian practitioners. It is said to excite digestion and promote appetite. It is also used in piles, diarrhoea, and skin diseases (Dutt).

Plumbago capensis Thunb.

The Cape Leadwort.

(This species, which is indigenous in South Africa, was first collected by Dr. Carl Thunberg).

Description.—A woody, sub-scandent shrub with striate stems. The leaves are entire, oblong or oblong-spathulate in shape, obtuse or acute at the apex, glabrous, tapering downwards into a very short petiole, up to 2 in. long by 1 in. wide at the broadest part. The under surface is covered with a white scurfy glandular excretion.

The inflorescence is a terminal raceme; rhachis puberulous. The flowers are seated on very short pedicels supported by bracts and bracteoles. The calyx is gamosepalous, about .4 in. long, with 5 acute, triangular lobes at the top, 5-ribbed, each rib rather fleshy and ending in the tip of a lobe. The calyx between the lobes is somewhat membranous. In the upper half the calyx bears numbers of stalked glands with swollen, purple, viscid tips. The corolla is pale blue in colour; tube about 1.5 in. long, 5-lobed, each lobe about .5 in. long, obovate-obtuse in shape with a well-marked central vein of a darker blue. Stamens 5, blue, on long filaments the length of the corolla tube. Filaments dilated at the base into what appears to be five nectar-secreting glands. The ovary is shortly stipitate, 1-celled, with 1 pendulous ovule. Style simple, as long as the tube, ending in 5 feathery stigmas, from a basal funicle. Capsule oblong-clavate, rounded above, tapering and pentagonal below.

Flowers.—Practically throughout the year, but in profusion during July-October and December-March. Does not set seed in this country.

Distribution.—Native of the Cape of Good Hope; now widely cultivated in gardens throughout the plains of India.

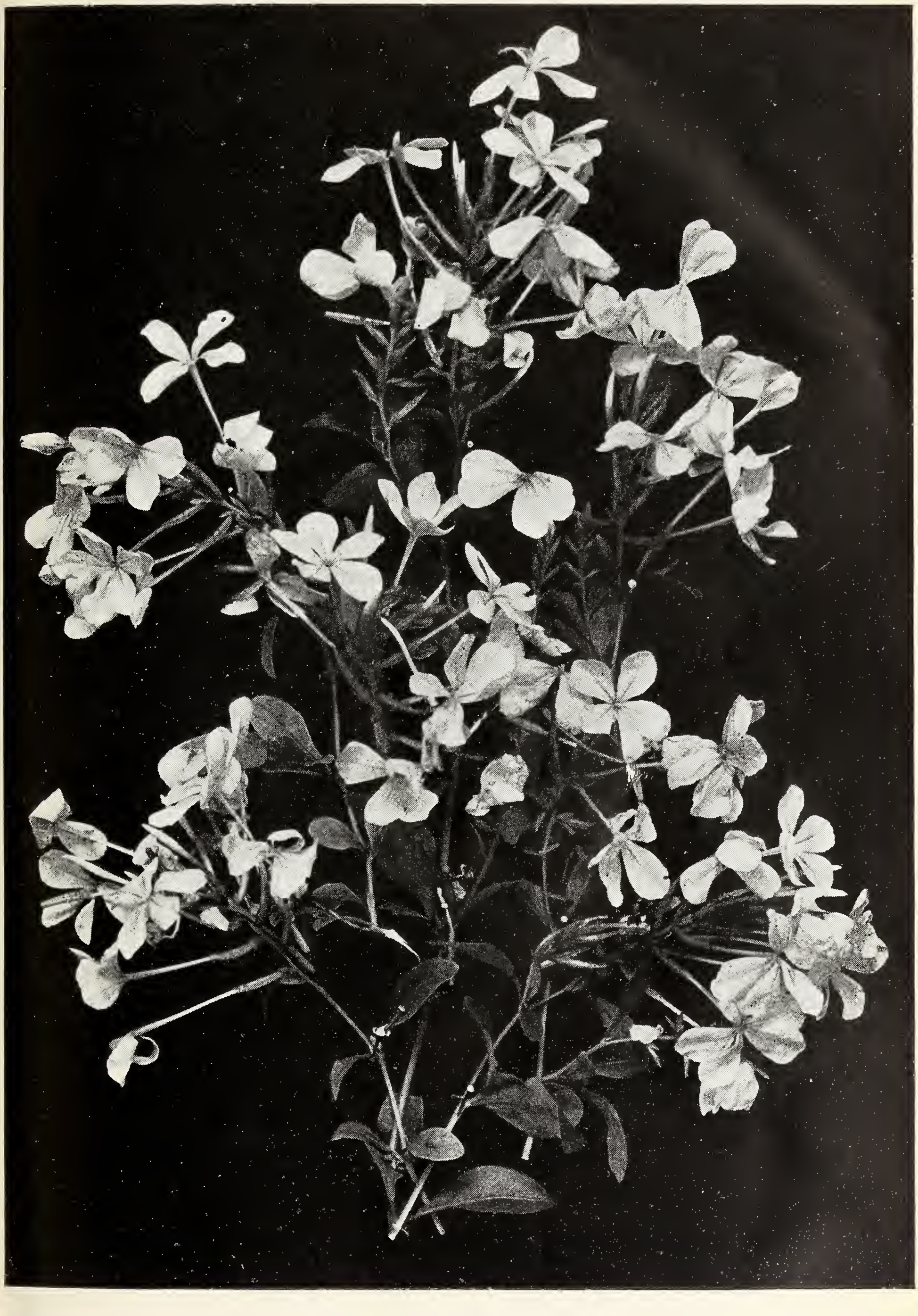
Gardening.—An evergreen, sub-scandent or straggly upright bush with beautiful azure-blue flowers. It is one of the commonest as also one of the most ornamental plants of our Indian gardens. It is advisable to remove all dead wood and old stems, as it is on the new shoots that the best flowers are produced. In South California and elsewhere if planted against a tree it will climb up to 15 ft. or so. It is best suited for borders or as a bedding plant or even for pot planting. Usually propagated by suckers or division of roots, as cuttings are less successful. It is apt to be cut back by frost where it is severe. There is a white variety similar in every way to the blue except for the colour of the flower.

Plumbago rosea Linn.

Rose-coloured Leadwort.

(*roseus* refers to the colour of the flowers of this species).

Description.—A perennial shrub with obscurely striate scandent branches. Leaves alternate, shortly petiolate, broadly ovate or elliptic in shape, up to 8 in. long by 3 in. broad, glabrous; entire, dark green above, pale below; petiole short, dilated and half-amplexicaul.



Plumbago capensis Thunb.
New Forest, Dehra Dun.

Photo by M. N. BAKSHI.

Photo by M. N. BAKSHI

New Forest, Dehra Dun

Inflorescence a terminal raceme up to 2 ft. long. Individual flowers spaced, often secund, seated on short pedicels, with bracts and bracteoles; rhachis glabrous. Calyx gamosepalous, .3 in. long, 5-ribbed and 5-lobed, the lobes short triangular acute, covered with very numerous gland-tipped stalked hairs. The corolla tube is 1.25 in. long; slender with 5 rounded lobes about .5 in. long, of a beautiful brick-red colour. Stamens 5, on long filaments. Ovary stipitate, 1-celled, 1-ovuled. Style long and hairy towards the base, ending above in 5 definite stigmas. Fruit a capsule contained in the glandular persistent calyx.

Flowers.—Cold season, but also at other times of the year.

Distribution.—Native of Sikkim and Khasia. Extensively cultivated in the tropics of both hemispheres.

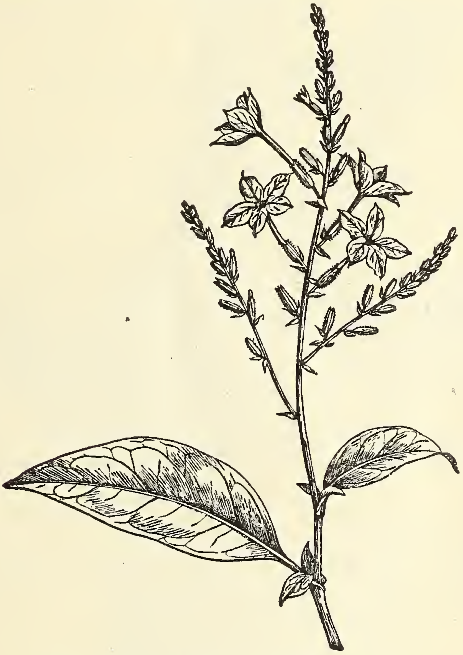


Fig. 2.—*Plumbago rosea* Linn. ×½.

Gardening.—A small shrub with pretty red flowers. It is an excellent subject for winter blooming in pots. Propagated by offsets.

Medicinal uses.—It possesses medicinal properties similar to those of *P. zeylanica.*

Plumbago rosea Linn. var. *coccinea* is a form with larger scarlet flowers and more common under cultivation than the type.

THE GAME FISHES OF INDIA.

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.,

Director of Fisheries, Bengal.

(*With one black and white plate and one text-figure.*)

(*Continued from page* 8 *of Vol.* xliv, *No.* 1.)

XVII. THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

10. ON THE SPECIFIC IDENTITY OF JERDON'S SPECIES OF MAHSEER FROM SOUTHERN INDIA.

Under the genus *Barbus* Cuvier, characterized by 'Dorsal short, preceded by a strong spine; 4 cirri', Jerdon (**8**, pp. 311-314)[1] described or recorded a number of species from Southern India, but he examined specimens of only a few of them. Of these, several are provided with a serrated dorsal spine, and some of those in which the spine is entire the number of scales along the lateral line exceeds 30 and in all probability the labial groove is interrupted in them. Excluding fishes of these two categories from his list of 14 species of *Barbus* there are five, *viz.*, *B. hamiltonii, B. megalepis, B. malabaricus, B. mussullah* and *B. khudree,* which may be considered here.

He regarded *Barbus progeneius* McClelland as synonymous with *Barbus* (*Labeobarbus*) *hamiltonii* (Gray), which he described as follows:—

> 'Head to the whole body as 1 to 3½; cirri long; a fleshy projection on both upper and lower lips; body compressed; its height is to total length as 1 to 3½ —26 scales along the lateral line, in 6 rows; green above, cheeks golden, silvery beneath; fins tinged with orange red; D. 3-9, 3rd spine simple, very strong; A. 2-5, etc.'

In recording *Barbus khudree* Sykes, of which no specimen was examined, Jerdon observed that 'If Colonel Sykes had not given 14 rays to the dorsal fin I might have considered it the same as *B. Hamiltonii.*' I (**4**, p. 521) have discussed in an earlier article that Gray's *Tor hamiltonii* (=*Cyprinus tor* Hamilton) is the Tor Mahseer of Northern India, but in identifying the Peninsular form *B. khudree,* with McClelland's *B. progeneius,* Jerdon seems to have been influenced by the character of the enlarged lips, which is probably common to all species of Mahseer. He observed:

> 'This fine fish is one which in the South of India most nearly resembles the *Mahseers* of Bengal, but I am not aware of its having been taken by fly

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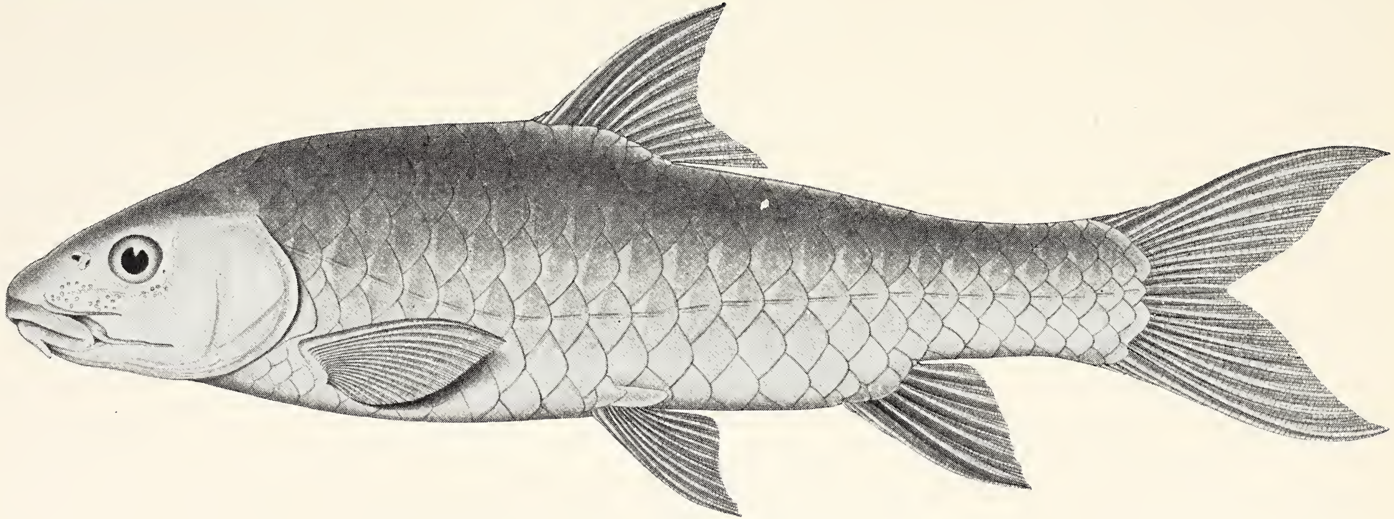
[1] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.



Barbus (Tor) khudree, Sykes. From Canara, Malabar.

here. It is found in the Cavery and all its tributaries, and grows to a size I am told, of 2 to 3 feet. It is a very handsome fish. I am not certain of its being McClelland's fish, which appears to differ somewhat in colouring, in the size of the head, and in wanting the projection on the upper lip. The drawing in Gray and Hardwicke gives a very fair representation of our southern fish.'

In the last article of this series (6, p. 7), the head and anterior part of body of a specimen of *Barbus khudree* Sykes collected by Dr. Rishworth in the Uhlas River, 40 miles north of Bombay, were figured to show the greatly hypertrophied lips and there seems no doubt that Jerdon had a somewhat similar specimen which he referred to *Barbus* (*Labeobarbus*) *hamiltonii* (Gray). This fish is very much like the Mosal Mahseer of the Himalayas and, but for the tubercles on the cheeks, is almost indistinguishable from it.

Jerdon recorded *Barbus megalepis* McClelland from South India with a query and stated:

> 'I obtained a single small specimen of what I consider may be this fish in the Cavery at Seringapatam. It was only a few inches long, but the fishermen, who call it *kilche,* said that it grew to an enormous size.'

He characterized it as: 'Head is to body as 1 to 3; 25 scales along the side in 6 rows; D. 12, A. 7.'

In the preceding article (6) it has been shown that the Mahseer of Peninsular India that grows to an enormous size is *Barbus mussullah* Sykes and evidence was adduced to show that Jerdon's *B. megalepis* is synonymous with it.

Barbus malabaricus was characterized by Jerdon as follows:—

> 'Head to whole body as 1 to 4; height 3½ times in its length; 4 long cirri; 23 scales along the body in 6 rows. D. 3-8. A. 2-8; pale brownish olive above; silvery beneath; fins tinged with red.'

He further stated:

> 'I have taken this handsome barbel only in mountain streams in Malabar. It rises to the fly sometimes, and will also take a bait of boiled rice. I have not seen it more than 10 inches long, but from the rapid growth of one I have kept alive for some months I imagine it attains a much larger size.'

Judging from the above description, the species is insufficiently characterized, and probably for that reason Day (1) did not even mention it in his 'Fishes of Malabar'. Günther (3, p. 82, footnote) included it among the doubtful species of *Barbus*. In his 'Fishes of India', however, Day (2, p. 569) gives a detailed description of the species and includes it among those with 4 barbels in which the last undivided dorsal ray is articulated, or if osseous very weak. He gives the distribution of the species as 'From South Canara down the Western Ghats to the Travancore hills. Mr. Ballard has captured it at Courtallum with a fly. It attains at least 18 inches in length.' As regards its colour, he stated: 'bluish, becoming white on the abdomen. Fins usually blue. Eyes red. Sometimes the fish is brown: and the dorsal, pectoral, and ventral red. Or the front edge of dorsal and anal and upper and lower borders of the caudal may be dark.' The variation in colour exhibited by the Malabar Mahseer is shown by Thomas (9) in the first three plates of the 2nd edition of his 'Rod in India'.

I have examined Day's specimens from Canara and found that though the dorsal spine is relatively very weak, they are in all other respects (*vide* table of measurements given below) very similar to *B. khudree* Sykes (**7**, pp. 24-28), even in the presence of tubercles on the sides of the head (see plate). In the case of *Barbus* (*Lissochilus*) *hexagonolepis* McClelland (**5**, p. 82), it was pointed out that owing to great variation in the size and strength of the dorsal spine no reliance could be placed on it as a character of specific value. Further, I have examined only a few specimens of *B. malabaricus* and for the time being, therefore, I am unable to separate *malabaricus* from *khudree* specifically.

It may, however, be noted that, as is the case of other Mahseers discussed in the preceding articles, the nature of the lips varies considerably even in this form. This is clearly shown in Day's two specimens of *malabaricus* from Canara (Text-fig.).

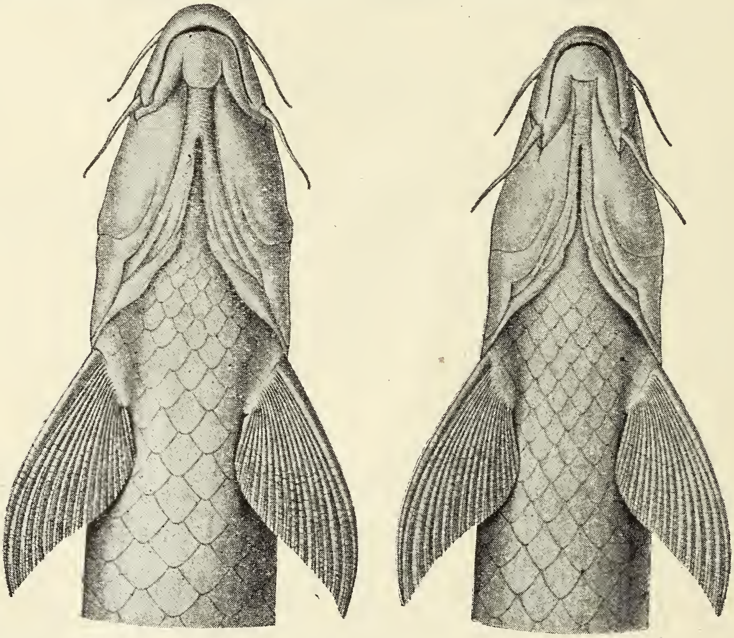


Fig. 1.—Ventral surface of head and anterior part of body of two specimens of *Barbus* (*Tor*) *khudree* Sykes (=*B. malabaricus* Jerdon) from Canara collected by Day (Z.S.I. Register Nos. 2380 and 2394), showing variation in the form and structure of lips. ×2/3.

Thus among the five species of the *Tor*-type included by Jerdon in his list of South Indian fishes, we have the following two types:—

1. *Barbus khudree* Sykes =*B. hamiltonii* Jerdon *nec* Gray.
   =*B. malabaricus* Jerdon.
2. *Barbus mussullah* Sykes =*B. megalepis* Jerdon *nec* McClelland.

Both *B. khudree* and *B. mussullah* have already been described in fair detail in the two preceding articles of this series. However, I give below measurements, etc. of four specimens of *B. malabaricus* Jerdon for convenience of reference in future. It will thus be seen that throughout Peninsular India there are probably only two types of Mahseer which are widely distributed in all the principal rivers.

TABLE OF MEASUREMENTS IN MILLIMETRES AND SCALE-COUNTS

	Canara		Tenmalai	
Total length	300·0	326·0	125·0	225·0
Standard length	233·0	256·0	98·0	179·0
Length of head	61·5	67·0	26·0	47·0
Height of head	45·5	48·0	17·5	34·0
Width of head	34·0	36·0	15·5	30·5
Diameter of eye	15·0	16·0	9·0	12·5
Length of snout	20·0	25·5	9·5	15·0
Interorbital distance ...	24·0	26·0	9·0	17·0
Width of body	35·5	36·5	16·0	30·5
Depth of body	70·0	68·0	28·5	54·0
Length of caudal peduncle ...	42·0	48·0	19·0	31·0
Least height of caudal peduncle	29·0	31·0	12·0	23·0
Length of dorsal fin ...	57·0	54·0	22·0	39·0
Length of pectoral fin ...	49·0	51·5	19·0	35·0
Length of pelvic fin ...	44·5	44·0	15·5	30·0
Length of anal fin ...	50·0	48·5	18·0	33·5
Length of rostral barbel ...	15·0	16·0	5·0	10·0
Length of maxillary barbel ...	17·5	19·0	6·5	12·0
No. of predorsal scales ...	9	9	9	9
No. of scales along L. l. ...	23	23	23	23
No. of scales between L.l. and V.	2½	2½	2½	2½

ACKNOWLEDGMENTS.

As in the case of the previous articles, the entire cost of illustrations was borne by the authorities of the Bombay Natural History Society and to them my best thanks are due. I am obliged to Mr. K. S. Misra, Fish Assistant, Zoological Survey of India, for drawing up the table of measurements and to Babu S. Mondul for the execution of the illustrations.

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3. Günther, A.—*Catalogue of the Fishes of the British Museum*, vol. vii, p. 82 (London, 1868).

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EXPLANATION OF PLATE.

Lateral view of a specimen of *Barbus* (*Tor*) *khudree* Sykes (=*B. malabaricus* Jerdon) from Canara collected by Day (Z.S.I. Register No. 2394) ×4/7.

Notice the weak and articulated dorsal spine; series of small tubercles on the cheek, small number (23) of scales along the lateral line and 2½ rows of scales (not 1½ as described by Day) between lateral line and base of pelvic fin.

THE LARGER DEER OF BRITISH INDIA.

BY

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Part IV—The Chital (*Axis*) and the Hog-Deer (*Hyelaphus*).

(*With text-figures* 4-8).

(*Continued from page* 37 *of this volume*).

The remaining two species of Indian Deer to be dealt with, namely the Chital, Axis or Spotted Deer, and the Hog-Deer differ essentially from those already described in two main structural features:—(1) There is a long, deep, glandular cleft in the middle of the pastern of the hind foot, which is absent in the others (Fig. 4); (2) the crowns of the median lower incisor teeth, when unworn, are greatly expanded, the free edge considerably exceeding in width the combined widths of the three teeth outside them (Fig. 5). Also the upper canine teeth are typically absent in both sexes. Lydekker, it is true, says, on unstated authority, that they are generally absent in *Axis* and this is repeated, perhaps copied, by Phillips. They are entirely absent, however, in all the numerous skulls

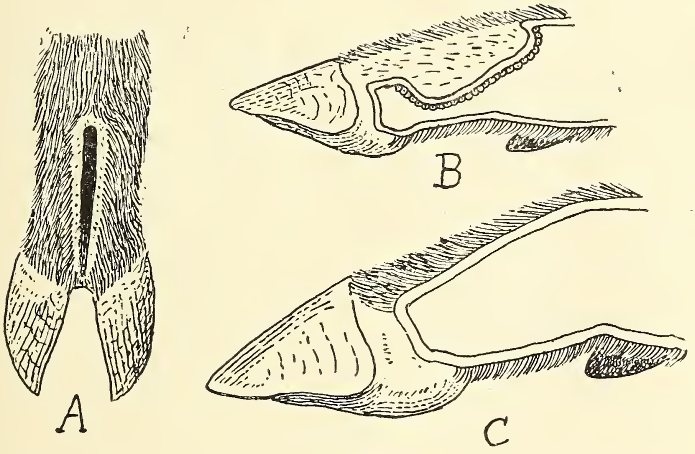

Fig. 4.

A. Anterior view of hind foot of a Chital (*Axis axis*) showing the dilated orifice of the interdigital gland which is also present in the Hog-Deer (*Hyelaphus*).

B. Section of the same foot showing the glandular pit and the layer of secreting cells.

C. Section of the hind foot of a Sambar (*Rusa unicolor*), showing the absence of the glandular pit which is also absent in other large Indian Deer.

examined in the British Museum. The antlers, as is well known, are simple and three-tined as in the Sambar, the three species having alike retained this primitive feature, which is not an indication of affinity between them.

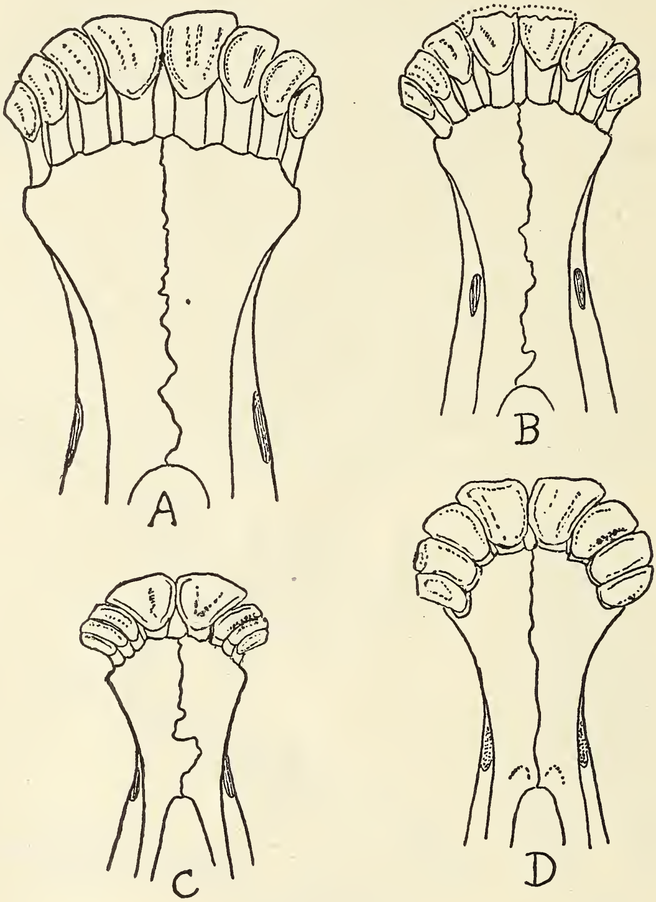

Fig. 5.

A. Incisiform teeth of old ♂ Wallich's Deer (*Cervus wallichii*), the stag imported alive from Nepal.

B. The same of Schomburgk's Deer (*Thaocervus schomburgki*), the age shown by the exposed roots of the teeth, as in *A*.

C. The same of adult ♀ Sambar (*Rusa unicolor*) from Satara (Prater), much younger than *A* and *B* as shown by the unexposed roots.

D. The same of adult ♀ Chital (*Axis axis*) from the Nallamalai Hills (La Personne).

Genus **Axis**, H. Smith.

(The Chital or Spotted Deer).

Axis, Ham. Smith, Griffiths' An. King., 5, p. 312, 1827, and of many subsequent authors, sometimes as a genus, sometimes as a subgenus of *Cervus.*

Type of the genus.—*Cervus axis* Erxleben.

Distribution.—India and Ceylon.

In addition to the characters mentioned above, the distinguishing external features of this genus are the conspicuous pattern of white spots extending at all seasons over the upper side from the neck backwards; the smooth short coat, forming no mane on the neck; the legs are normally long and the brow tines are externally divergent and form a nearly rectangular junction with the beam.

Axis axis, Erxleben.

Cervus axis Erxleben, Syst. Regn. An., p. 312, 1777; and of most subsequent authors (based on the *Axis* of Pennant Syn. Quadr., p. 51, 1771).

Cervus nudipalpebra Ogilby, Proc. Zool. Soc., 1831, p. 136.

Axis maculatus Jardine, Nat. Libr., 3, p. vi and p. 167, 1935, and of several authors (substituted name).

Locality of the types of *axis, nudipalpebra* and *maculatus* : 'the banks of the Ganges'.

Distribution.—India and Ceylon.

The only skin available for description is a mounted Indian specimen (Duke of Bedford). The general colour is brownish fawn, the darkening being due to the black tips of the hairs, which are more conspicuous on the nape and on the sides of the lower neck below the cheek, but die away on the lower side of the neck which is fawn except for a large white patch in front; the spinal area is blackish and this extends as a black streak up the nape to the head; the upper part of the sides of the neck, the backs of the ears, the cheeks, sides of the muzzle and round the eyes is pale creamy buff, but the forehead is brownish fawn and this area extends as a dark angular V-shaped point in front of the eyes and is sharply set off by the pale hue above the eyes and on the sides of the muzzle; there is also a dark patch on the top of the muzzle, behind the rhinarium; and another at the corner of the mouth, but the chin and lower side of the jaws are white; the breast, belly, scrotum and inside of the thighs and lower side of the tail are also white; the limbs externally become gradually whiter towards the hoofs. The pattern of white spots extends from the neck and shoulders but is absent from the head, throat, tail and limbs below the line of the belly; the spots show a definite longitudinal lineal arrangement along the spine and low down on the flanks above the belly; elsewhere they are more irregular; but on the hinder part of the thigh they form a vertical white stripe.

For the Ceylonese Spotted Deer, Lydekker in his Catalogue, Vol. 4, p. 51, 1915, adopted the subspecific name *ceylonensis* proposed by Fitzinger in 1874; and Phillips (Man. Mamm. Ceylon, p. 329, 1935) followed him and published three photographs of the entire animal and one of a mounted head. According to Lydekker the spots are smaller in *ceylonensis* and the forehead has no dark horseshoe mark. I am unable to distinguish the body-pattern shown by Phillips's photographs from that of the Indian specimen described above and the horseshoe or V-shaped mark on the forehead is clearly indicated, thus contradicting Lydekker's statement on that point and his amplification of it that the forehead is all brown. He also says that *ceylonensis* is yellower and paler fawn in its ground colour. That alleged difference I am unable to check; but the description of the head was taken from his type of *zeylanicus* (FIELD, 1905, p. 147) which has the forehead more uniformly brown and the chevron-mark hardly differentiated; but the brown patch behind the rhinarium above is continued laterally to the corner of the muzzle which is not the case in the Duke of Bedford's Indian skin, but is apparently indicated in Phillips's photographs.

The character, however, to which Lydekker apparently attached the greatest importance was the alleged thinner antlers in Ceylon specimens. Phillips, who followed him in this claim also, states that the three stoutest Ceylonese antlers known to him had a basal girth above the burr of 5½, 6 and 6½ in. In three skulls, collected by Mayor, and in the type of *zeylanicus,* the girth ranges from 4¼ to 4¾ in., the average girth of the seven being about 5½ in. In seven skulls from southern India the girth varies from 4¾ to 6 in., the average being 5 in., nearly the same as in the Ceylon skulls; and in fifteen heads from Garwhal, probably collected by St. G. Burke as being good trophies, the girth varies from 5 to 6½ in., agreeing very closely with Phillips's three picked Ceylonese heads, the average of the fifteen being 5½ in. From these data it seems that the subspecific status of *ceylonensis* is at present hardly admissible.

The skull of *Axis* is on the average about 2 in. shorter than that of *Panolia,* the smallest of the Deer of the preceding categories, and has the face relatively shorter, the distance from the posterior edge of the orbit to the tip of the muzzle being about twice the postorbital width, whereas in *Panolia,* which has the postorbital area exceptionally narrow, the face, so measured, is much more than twice that dimension. In *Rucervus* also the length of the face is well over twice the postorbital width.

There is a large collection of adult ♂ Indian skulls available from districts both to the north and south of the Ganges. Those from the north are on the average a little smaller than those from the south. The largest and smallest skulls from the north were collected by St. G. Burke in Garwhal. The total and condylobasal lengths of the largest are 286 and 275 mm. respectively and of the smallest 271 and 260 mm., the average of those dimensions in a large number of skulls, mostly from Garwhal, being 280 and 267 mm. The largest skull from the south, collected for the Survey by Baptista at Diguvametta in Kurnool, has the total and condylobasal length 302 and 290 mm. respectively: and the smallest collected for the Survey by Shortridge at Kanara, has those dimensions 277 and 269 mm., the averages of a considerable number from scattered localities being 286 and 275 mm. The average total in all the ♂ Indian skulls is about 11¼ in., and the average condylobasal about 10 4/5 in.

Only two ♂ skulls from Ceylon, both collected for the Survey by Mayor at Cheddikulam, are available. Their total and condylobasal lengths are 276, 266 mm. and 270, 256 mm., the averages being 273 and 261. Curiously enough they are noticeably smaller on the average than the southern Indian specimens, coming nearer the northern in size, although a little smaller. Their average total of just under 11 in. and average condylobasal of just under 10½ in. suggests that Ceylonese skulls may be a trifle shorter than Indian skulls; but the data from Ceylon are clearly insufficient.

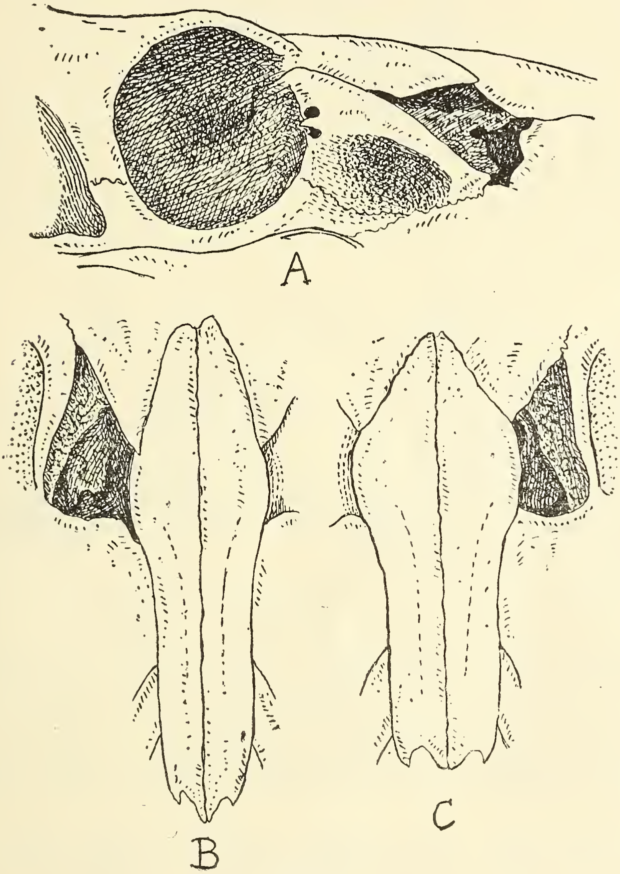

Fig. 6.

A. Orbital area with vacuity and gland-pit of adult ♂ Chital (*Axis axis*) from Kanara (Shortridge).

B. Nasal bones of the same specimen, with the vacuity and inner portion of the gland-pit (dotted) of the left side.

C. The same of adult ♂ Chital from Garwhal (St. G. Burke).

Figs. B and C show approximately the extreme variations in the species in the length and width of the nasal bones.

(Figs. two-thirds nat. size).

As regards other skull-characters, the bullae are moderately inflated, about to the same extent as in *Panolia* and *Rucervus*, but show a good deal of individual variation, although always projecting below the surface of the occipital bone between them. The nasals are always expanded posteriorly between the vacuities; their free edges at this place being usually about 15 mm. long, but varying from about 9 to 18 mm.; the interfrontal penetration of the nasals is usually about on a level with the posterior ends of the vacuities, but may extend as an acute angle some 15 mm. beyond. The vacuities are wide as compared with their length which in almost all cases is less than the vertical diameter of the orbit which averages about 43 mm. The gland-pit is moderately large, but rather shallow and, although varying to a certain extent individually, is always much shorter than the vertical diameter of the orbit (Fig. 6).

Three adult ♀ skulls were collected for the Mammal Survey in southern India. Their histories and total and condylobasal lengths are—Dharmapuri, Salem (Baptista) 260 and 242 mm.; Nallamalai Hills (La Personne) 257 and 246 mm.; Palkonda Hills (Baptista) 241 and 231 mm., the averages of these dimensions being 253 mm. (about 10 in.) and 239 (about 9 3/5 in.). They are thus about 1½ in. shorter respectively than the ♂ skulls from southern India.

Genus **Hyelaphus,** Sund.

(The Hog-Deer).

Hyelaphus, Sundevall, K. Svenska Vet.-Akad, Handl., 1844, p. 181 and of many subsequent authors either as a genus or as a subgenus of *Cervus* or of *Axis.*

Type of the genus.—Cervus porcinus.

Distribution.—Northern India, Burma, Siam, Annam, some of the Philippine Islands; also Ceylon, where it is believed to have been artificially introduced.

Distinguished from *Axis* in external characters, as has frequently been recorded, by its colour, smaller size, shorter legs imparting a more crouching gait, and by the nearly erect brow tine diverging from the beam at an acute angle. In the skull the antler-pedicles are relatively longer, the gland-pit is at all events relatively larger, and deeper, not shallower as stated by Lydekker, the bullate portion of the auditory bone is actually larger, being more inflated in three dimensions, although the skull is smaller, and the nasal bones are less expanded between the vacuities, being typically nearly parallel-sided (Fig. 7).

This diagnosis is taken from the typical British Indian species, the species or races assigned to *Hyelaphus,* and found to the east of Burma being too little known at present for inclusion.

Hyelaphus porcinus, Zimm.

(The Hog-Deer).

Cervus porcinus Zimmermann, Spec. Zool. Georg., p. 532, 1777; and of later authors as *Cervus, Cervus* (*Axis*), *Cervus* (*Hyelaphus*), *Axis, Axis* (*Hyelaphus*) or *Hyelaphus.* (Based on the Porcine Deer, Pennant, Syn. Quadr., p. 50, 1751).

? *Cervus pumilio* H. Smith, Griffiths' An. King., 4, p. 120, 1827; *id. op. cit.* 5, p. 312, 1827, as *Cervus* (*Axis*).[1]

Locality of the type—of *porcinus*.—'India'; of *pumilio* unknown.

Distribution.—'The Indo-Gangetic plains of India from Sind and the Punjab to Assam and thence to Burma'; extending north of the Ganges to the United Provinces, Nepal and Bhutan Duars.

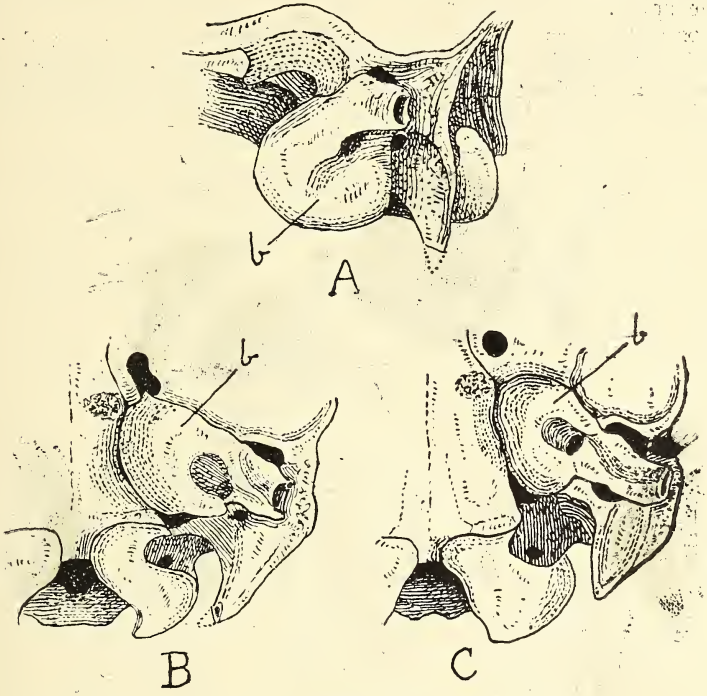

Fig. 7.

A. Side view of the left bulla and surrounding bones of a Hog-Deer (*Hyelaphus porcinus* from E. Nepal (Baptista), showing the bulla (*b*) projecting below the level of the occipital bone.

B. Lower view of the bulla (*b*) and surrounding bones of the same specimen.

C. The same of a Chital (*Axis axis*) from the Palkonda Hills (Baptista), showing the relatively smaller, less inflated bulla (*b*) than in the Hog-Deer (*Hyelaphus*).

The only skin available for description is that of a mounted adult ♂ from Burma (Evans). The general colour above and below is fawn brown, with very faint traces of some paler spots on the flanks, but more along the spinal area which has no dark median stripe; the sides of the neck, the cheeks and back of the ears are decidedly paler than the body, nape and top of the head, but the muzzle is darker brown, especially on the corner of the mouth; the front of the upper lip and the chin are white and the white from the chin extends backwards over the lower jaw to the front of the neck which, like the chest, is brown; the lower side of the tail, the inner sides of the thighs and the scrotum are white.

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[1] The type of *pumilio* was the very young frontlet and antlers of some quite unidentifiable deer. It was in the Museum of the Royal College of Surgeons; but since that historical collection was destroyed by a bomb in 1940, the species will never be determined. To get rid of the name I follow Lydekker's lead and add it to the synonymy of *porcinus*.

This specimen agrees in a general way with the current descriptions of typical *porcinus*, mostly derived from Blanford who observed for a few years a seasonal change in living specimens the colour being paler in summer and showing spots especially on each side of the spine.

Some features of the skull were briefly alluded to under the generic diagnosis. Additional particulars are as follows:—The largest and smallest complete ♂ skulls were alike collected by St. G. Burke at Bijnor in the United Provinces. The largest has the total and condylobasal lengths 241 and 232 mm. respectively; the smaller has those dimensions 226 and 218 mm. The average total length of eight ♂ skulls is 233 mm., about 9 1/3 in. and the average

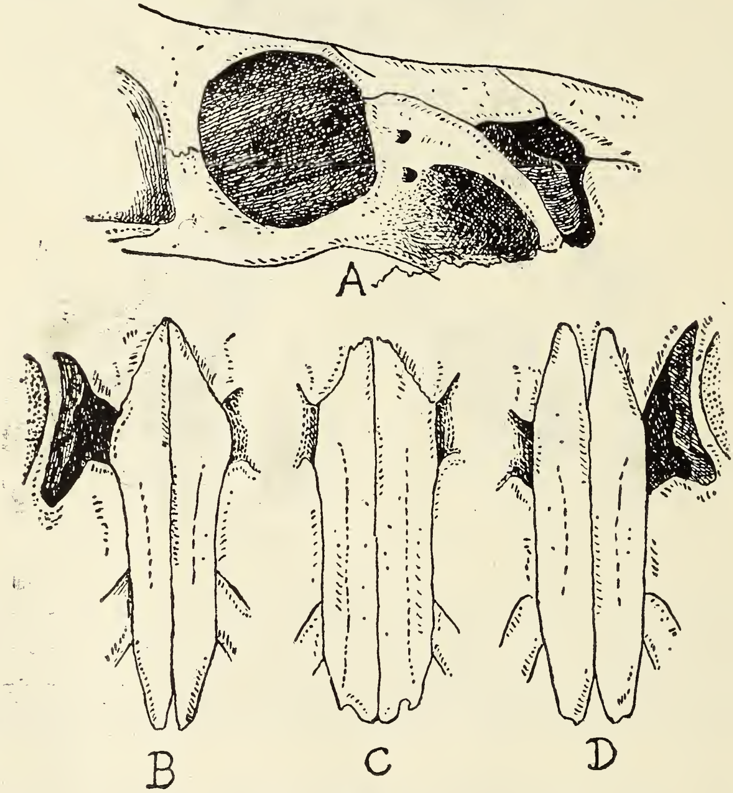


Fig. 8.

A. Orbital area with vacuity and gland-pit of adult ♂ Hog-Deer (*Hyelaphus porcinus*) from Bijnor (St. G. Burke).

B. Nasal bones, with vacuity and portion of gland-pit (dotted) of right side of the same specimen.

C. Nasals of another adult ♂ Hog-Deer from Nepal (Baptista).

D. Nasals, with vacuity and inner portion of gland-pit (dotted) of Hog-Deer from the Upper Chindwin (Bruce).

condylobasal length of six is 224 mm., about 9 in. The skulls of *Hyelaphus* are thus on an average about 2 in. shorter than ♂ skulls of *Axis*. Actually the shortest ♂ skull, collected at Panichatta in Bengal, has a total length of 224 mm., about 9 in.

The face is relatively shorter, as compared with the total length, than in *Axis*. In eight skulls the average length from the front edge of the orbit to the tip of the muzzle is 122 mm., a little over half the total length which exceeds twice the facial length by only 11 mm. The orbit and vacuity are about the same relative size as in *Axis*, but the gland-pit is on the average deeper, with better defined edges, and the nasals between the vacuities are narrower, the bones being typically nearly parallel-sided from the premaxillae to the frontals, although sometimes a little expanded where they abut against the vacuities (Fig. 8). The most noticeable difference however, between the two lies in the size of the auditory bones (Fig. 7). The oblique width of the bone from the auditory orifice to the inner anterior margin of the bulla is 40 mm. in an average of seven skulls, approximately the same as in *Axis* with its considerably larger skull; and the swollen or bullate portion of the bone is more inflated vertically, transversely and longitudinally, its average total length, excluding the apical spike, being 26 mm., actually 5 or 6 mm. longer than in *Axis*.

Apart from the absence of antler pedicles, the skulls of the ♀ Hog-Deer differ from those of the ♂ in being exceptionally narrower across the upper rim of the orbit behind and, as normally in the family, shorter. There are only four skulls available, two from Nepal, one from Bharnabari in Bhutan Duars (Baptista) and one from the Dibong River, Assam (Wells), the last two, collected for the Mammal Survey, being respectively the longest and shortest. The total and condylobasal lengths of the one from Bhutan are respectively 232 and 222 mm., the same dimensions of the one from Assam being 213 and 206. The average total length of all the skulls is 222 mm., about 8 4/5 in.; the average condylobasal of three is 8 3/5 in. The orbit and vacuities are about the same as in the ♂, but the gland-pit is shallower and about 5 mm. shorter on the average.

Hyelaphus porcinus oryzus, Kelaart.

Axis oryzus Kelaart, Prodr. Faun. Zeyl., p. 83, 1852.

Axis oryzus Blyth, Journ. As. Soc. Beng., 23, p. 217, 1854.

Hyelaphus porcinus porcinus Phillips, Man. Mamm. Ceylon, p. 333, 1935.

Locality of the type.—Ceylon.

Distribution.—'The wet zone along the west coast from a few miles north of Kalutara southwards towards Kottawa, west of Galle' (Phillips).

Distinguished from the typical race, on the evidence cited below, by its smaller skull and, on the average, smaller antlers and by the usual absence of any marked seasonal change of colour and the absence of spots in the adults.

Racial status has hitherto never been granted to the Ceylonese Hog-deer. A remarkably small adult skull in the British Museum drew my attention to the possibility of its distinctness from the north Indian and Burmese race and some confirmatory items favouring this idea were found in Phillips's account.

As regards the colour, Phillips, after referring to Blanford's description of the Indian Hog-deer, which says that the summer coat is paler and more rufous (than the winter coat) and more or less spotted with pale brown or white, the spots being sometimes restricted to one or two rows along the spine, states that in Ceylon he has 'never seen any sign of such spotting in the adult' and expresses the doubt about the occurrence of any marked seasonal change in colour. Similarly in connection with the antlers, he quotes some measurements of Indian specimens which, as stated above, may exceed 20 in. in length, and adds that in Ceylon 'the antlers appear as a general rule to be much smaller,' the largest of which he has a record measuring only 13 in. in length.

Kelaart described the Ceylonese Hog-deer as about two-thirds the size of *Axis maculata* and light fawn brown with two parallel lines of small white spots along the medial line of the back and some white hairs interspersed on the sides and upper parts of the limbs; the under side and lower side of the tail being whitish. This description fits the youngish hind referred to by Phillips as the only specimen showing spots seen by him. The horns, according to Kelaart, are small.

The skull from Ceylon (Zool. Soc.) above mentioned, is that of an old ♂. It is remarkably short, with a total length of only 218 mm. the length from the anterior edge of the orbit to the end of the muzzle only 111 mm. and from the occiput to the tip of the nasals only 178 mm. It is considerably shorter than the shortest ♂ Indian skull measured, one from Panichatta District, Bengal, in which those dimensions are respectively 224, 120 and 206 mm. Its total length of about 8¾ in. is 1 in. shorter than the average total length of the Indian skulls measured. On the other hand it is a relatively broad skull, probably owing to its age, its postorbital and orbital widths of 82 and 97 mm. respectively being about the same as the average in Indian skulls. The size of its orbit, vacuity and gland-pit are also about average, but the length of the nasal edge of the vacuity, 17 mm. is exceptionally long, greatly surpassing the average of Indian skulls.

Although the antlers are very short, the right being only 10¾ in. long and the left 10 in., they show obvious age decadence, the inner branch of the beam being short and conical on the right and altogether lost on the left antler.

Blyth first suggested that the presence of the Hog-deer in Ceylon is to be explained by artificial introduction; and according to Phillips there is a tradition that this was effected either by the Dutch or the Portuguese. The purpose of importing a small deer into the island, already containing the Sambar and Axis, is not clear; and Phillips says there is no record of when it took place, but since the species has been well established for a hundred years or more, it is entitled, he thinks, to rank as a Ceylonese animal. In this conclusion I fully concur, trusting that some zoologist on the spot will soon verify or refute the opinion that *H. p. oryzus* is a distinguishable race.

A NOTE ON THE FEEDING HABITS OF THE LITTLE BITTERN (*IXOBRYCHUS MINUTUS*).

BY

LT.-COL. R. S. P. BATES, M.B.O.U.

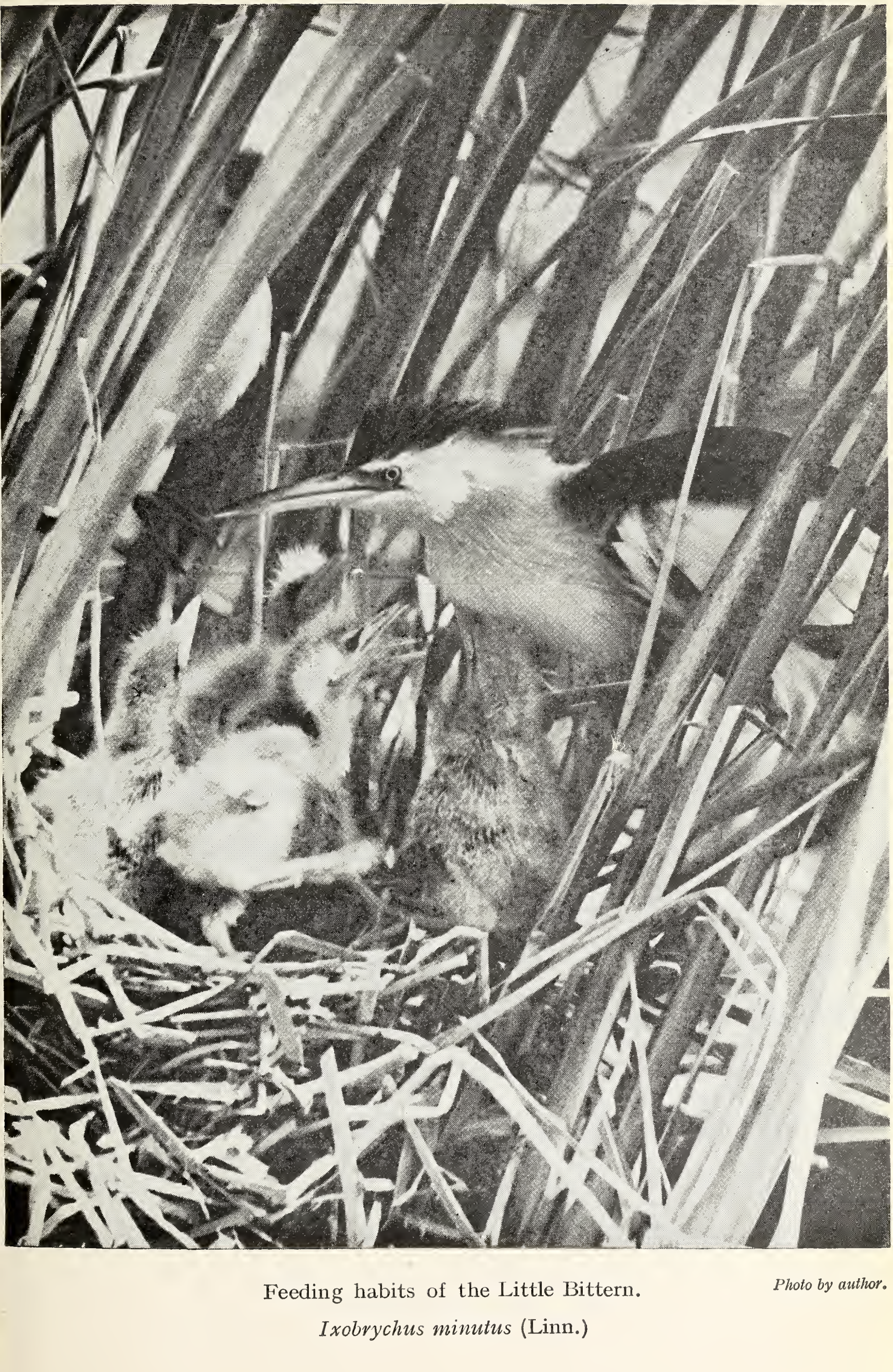
(*With two plates*).

Round about fifteen years ago I had my first experience of watching and photographing the Little Bittern from the hide. The habits of this denizen of the reed beds are so extraordinary that the episodes I then witnessed have remained impressed most vividly upon my memory. It has consequently remained my fixed intention to complete the series of photographs I then obtained with a further series of the young in the nest. I wished above all to depict the extraordinary manner in which the food is passed to them by their parents.

Last summer I found myself at the end of June in a houseboat on the Dal Lake with four days of my leave to go, and a good number of plates still unexposed. In a little backwater off the Nagim Bagh amongst the floating gardens I spent a few delightful hours photographing the Whiskered Terns, and discovered just as I was about to move off that three yards behind the shikara from which I had been operating was a Little Bittern's nest with 6 tousled youngsters in it. All I had to do was to part a way through the reeds I had been anchored against and transfer the camera to the back of the hide. The chicks as usual were of very different ages and development, ten days probably separating the oldest from the youngest, for the eggs are generally deposited at 2-day intervals while incubation starts with the laying of the first one. I anticipated therefore that I might have some difficulty in obtaining the photographs I required, as I knew from past experience that the chicks become wanderers as soon as they are strong enough to clamber out of the nest, and I have on occasion found an entire household distributed throughout the reeds in a circle some yards out from their home as if each one had started out on an independent voyage of discovery. True, I had also noted that they seemed to be in the habit of recollecting at the nest at night, in stormy weather, and often on being disturbed.

On this occasion I had not been long in the hide before all beaks were turned expectantly in the same direction. The two largest young ones clambered a couple of feet from the nest and a moment later I caught a glimpse of the male parent who stalked deliberately and silently past as if he did not own it. The young ones gazed sorrowfully after him but soon returned to their usual practice of jostling one another and on occasions making vicious stabs at young brother or sister just to remind me what quarrelsome brats they always are. In a former paper I once remarked that I thought this aggressive spirit must be a special dispensation whereby the smallest youngster by sheer ferocity should be enabled to obtain a share of the food, After a short lapse of time the male suddenly appeared on the edge of the nest where he stood rigidly to attention. He was evidently ill at ease, for he took no notice of the family at all and started clambering hand over hand up one of the stout supporting reeds on reaching the summit of which he flapped away uttering a single harsh croak as he did so. It is hardly correct to say he suddenly appeared at the nest for a Little Bittern seldom does anything suddenly. Rather do they fade in or out of the picture, as their movements are always so deliberate, solemn, and silent: except, that is, for the lightning dart of the bill at an unwary dragonfly or a silvery sprat required for the offsprings repast. The young ones too are as silent as their parents, their bills opening and shutting when asking for food without the noisy infantile chorus of most young birds.

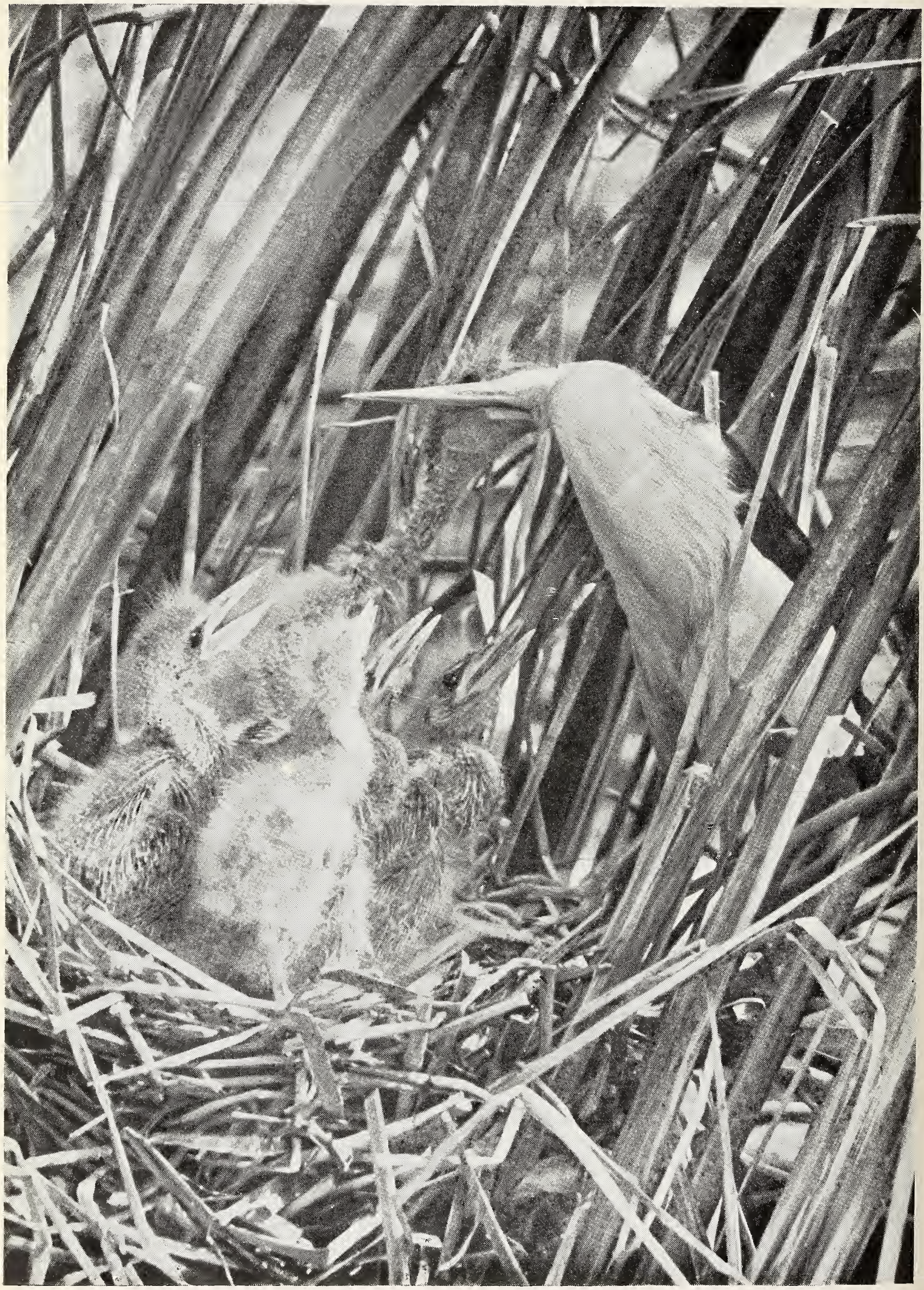
The two wanderers had immediately come home on the arrival of the male, and there they remained until he at last made up his mind to come and feed them. There then ensued those incidents I had witnessed so often before, but which so interested me that in watching every phase of the routine I had always failed to record them. On arrival on the nest, for a space he remained with bill horizontal; he then lowered it. This was the signal for an immediate attack upon his person by his seemingly ravenous horde. One of them seized his beak about halfway down but with a twist he freed himself. This, however, availed him nothing for the largest of the brood fastened on to him close to the base of the bill and there ensued a wrestling bout in the midst of which I took the accompanying photograph at a moment when his head was twisted right over but with no signs of his being able to break the aggressor's hold. Upon this the other five at once ceased to participate in the struggle and subsided into an attitude of anticipation with all eyes upon father. A moment later the latter forced his head down, his bill opening somewhat. A couple of heaves and there fell therefrom the semi-digested remnants, black in colour, of the regurgitated food for the brood. So broken up was it that on this occasion it was quite impossible to recognize its origin. It looked not unlike lumps, variable in size and crumbly in texture, of bazaar tobacco, and I was inclined towards the opinion that it was a jumble of insect remains. The main point of interest however is what happened to it. I have seen the young one in possession slide its own beak down that of its parent so that it was able to grab the food before it fell to the lot of one of its brethren. On this day however on all three occasions on which I witnessed the feeding process, not once did success crown the efforts of the bill-seizer, whereas the smallest member of the family was able to snatch up a sufficiency of fallen morsels for his needs. If the bill-seizer was generally successful in his attempts, one could readily understand the evolution of this curious habit. But a theory to fit in with its formation where the aggressor is more often than not quite unbenefited by his efforts, eludes me. Nature does not strike one as being philanthropic, so a habit on the part of the strongest which helps the weakest does not seem to fit in anywhere. Of course, a few intermittent observations from the hide at widely



Feeding habits of the Little Bittern.

Photo by author.

Ixobrychus minutus (Linn.)



Feeding habits of the Little Bittern.

Ixobrychus minutus (Linn.)

Photo by author.

spaced intervals, such as I have been able to carry out, not only provide quite inadequate data for solving such a problem, but are very apt to lead to erroneous conclusions. Should one be blessed with the opportunity to watch the growth of a family from the hatching of the first chick to the final departure of the whole brood, then perhaps some useful facts might emerge to guide one along the path to the correct interpretation of the Little Bittern's amazing behaviour.

'LIGHT-WINDOWS' IN CERTAIN FLOWERS.

(*Asclepiadaceae* and *Araceae*).

BY

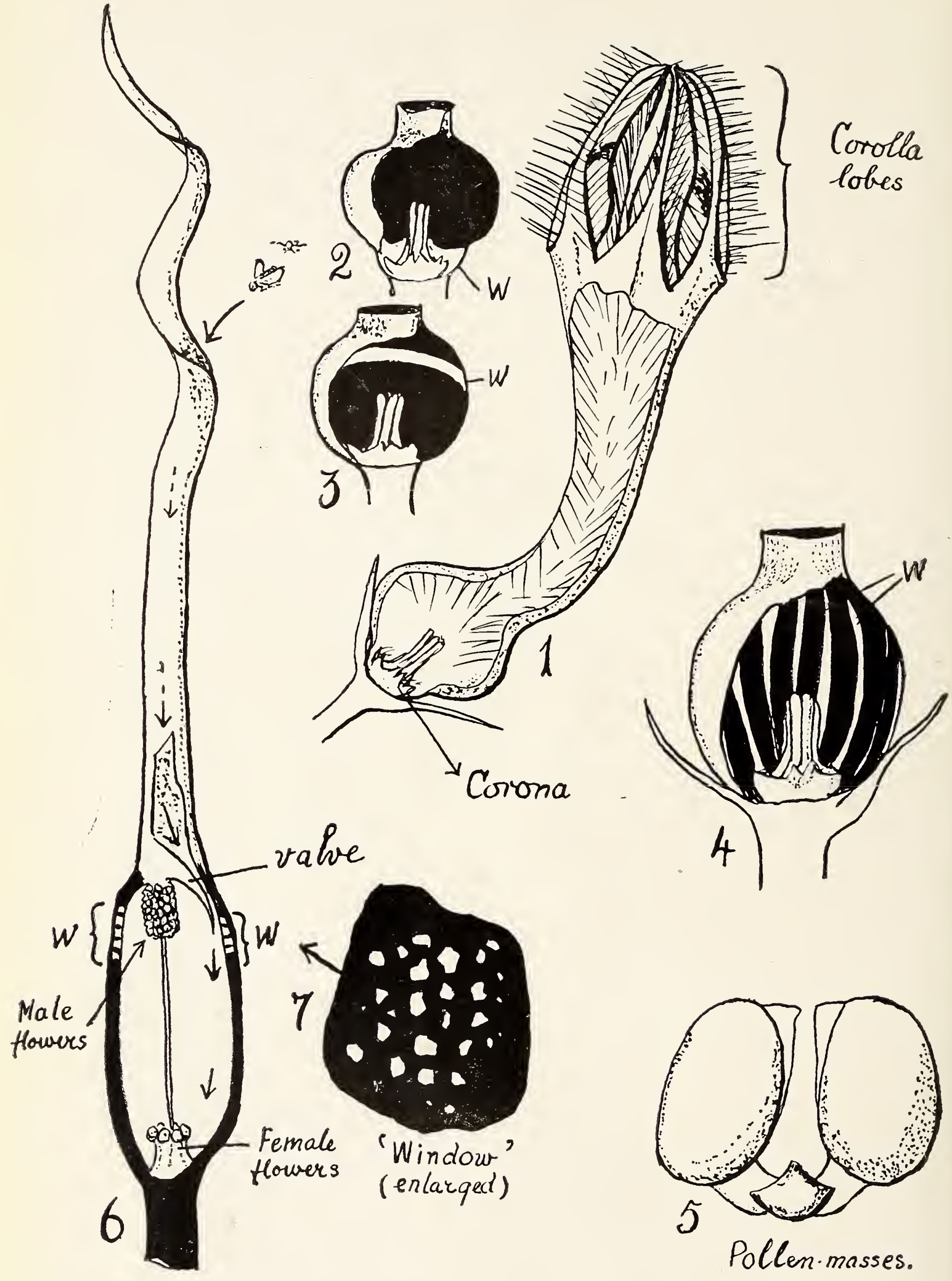
CHARLES McCANN, F.L.S.

(*With a plate*).

The title of the paper may, at first sight, seem rather curious, but its true significance will soon become apparent from what follows. It is well known that in the great economy of Nature animal agents, directly or indirectly play an important rôle in the pollination of flowers and the dispersal of seed, so much so, that it is doubtful whether certain plants could survive without their animal 'helpmates'.

Most plants that employ carrion feeding insects must appeal to the 'aesthetic' senses of their guests, and accordingly the 'hosts' produce flowers which resemble decomposing material in *colour, form,* or *scent* or better still, a combination of all three. Carrion and fruit flies (*Diptera*) are perhaps the chief guests. The flower may offer some form of refreshment, by way of food or drink, or a temporary home for the visitors or their young, or it may lure its visitors by mere bluff, and what is more, imprison them for a while under 'Act I of year 0'! In return for whatever form of hospitality they receive, the guests must transport the pollen from one flower to another, and thereby effect cross-pollination. Some such flowers, keep 'open house' and the guests come and go freely, irrespective of 'caste or creed'; others are more select in their choice of visitors, only the 'chosen' may enter and depart at will; lastly there are the 'highbrows' that are not merely highly exclusive in the choice of their guests, but are so overbearing in hospitality that they imprison the visitors, and only permit them to take their leave at their (the hosts') pleasure.

Flowers that invite carrion feeders generally range in shades of colour varying from pink, through purple, to almost black, mottled with green and yellow tints and finished off with a bluish gloss or bloom. The region in which the reproductive organs are situated is usually the deepest in colour, thus often making it quite dark within, especially in flowers which select and imprison their visitors. Carrion flies and fruit flies are usually diurnal insects and accordingly must have a certain amount of light to see and feed (remain active). Into such a darkened flower the flies would probably not enter, or if they did, would soon fall asleep. Nature in some marvellous way 'anticipated' this, and has invariably inserted a 'window' in such flowers, or rather, a translucent 'window-pane'. The 'window-pane' is a light-coloured area which admits light. Viewed from within it merely appears as a light coloured area in the region, and its true significance is not immediately apparent. The 'window' is so arranged that the light is focussed on to the reproductive organs. What a marvel!


Corolla lobes
2
W
W
3
1
Corona
W
4
valve
W
W
Male flowers
7
'Window' (enlarged)
Female flowers
6
5
Pollen-masses.

del. C. McCann.

'Light Windows'

[For explanation see end of article.

It is not my intention to pursue the subject of 'light windows' exhaustively in the plant world, but merely to draw attention to the formation of such 'windows' as observed by me in the course of studying certain plants in the field. My attention was drawn to this point particularly when engaged on the study of the genus *Ceropegia,* and subsequently I extended my observation to the genus *Cryptocoryne,* in which I knew of the existence of 'closed' flowers, darkened internally.

Flowers which have developed 'light windows' have usually developed devices to exclude top lighting and for darkening the chamber containing the reproductive organs. This is achieved by modifications in the corolla as in *Ceropegia* (Figs. 1-5), or by modifications in the spathe as in *Cryptocoryne* (Figs. 6 and 7). In both instances there is a more or less inflated chamber formed round the reproductive organs. In *Ceropegia* the corolla is remarkably inflated at its base to form a chamber round the reproductive organs (corona). Above the chamber the corolla is strongly constructed, and generally bent to form a funnel-shaped tube terminating in the five corolla lobes, which are united at their extremities. The chamber and part of the tube above are very deeply pigmented interiorly with purple. Thus it will be clear that, but for a 'window', the interior of the flower would be in darkness—the colouring of the inside, the bend in the corolla tube, and the union of the corolla lobes above the 'funnel' all contribute towards excluding direct light from the reproductive chamber. A glance at the accompanying figure will make matters clear. The inner surface of the corolla lobes, the throat of the funnel, and often the chamber itself are provided with stiff hairs, all pointing downwards. The amount of hairiness varies with the species. The hairs admit the visitors, but prevent their exit for they all face the visitors like so many spear heads—the intruders are trapped! Following the maturation of the pollinia (pollen masses) the flower stalk bends downwards, the hairs break down, and light is admitted down the tube and the flies make good their escape carrying with them the pollinia fixed to their head like pairs of horns.

In *Cryptocoryne* the construction is somewhat different. What appears to be the flower is in reality an inflorescence, and not a single flower as in *Ceropegia.* Nevertheless, the method of attracting visitors is much the same. The spathe, which may appear as a corolla, is converted into a reproductive chamber in its lower portion to contain the two groups of male and female flowers, the remaining upper part is twisted into a tube of varying length, according to the species. Externally the spathe is variously pigmented in dark hues, but internally it is a very deep purple, almost black at times. But for light windows the internal gloom would be further accentuated by the presence of a valve which separates the chamber from the tube above. This valve admits the visitors, but once in, there is no escape—it is a trap-door which will only open when the pollen is mature and the visitors are thoroughly covered with golden dust. The inner surface of the chamber is polished and may act as a reflector. The female flowers are situated at the bottom of the chamber and the males are fixed at the top near the valve. Both groups are connected by a thread-like process which may serve as a ladder. When the female flowers mature the spathe opens and gives off the necessary odour to attract visitors. These alight on the free end of the tube and in their ardour to discover the 'goods' advertised, enter the tube and finally press pass the valve into the chamber. The male flowers ripen next, giving out the pollen grains. The flies finding themselves trapped, fly round the chamber and towards the source of light, which in *Cryptocoryne* enters from two trellis-like grids at the top of the chamber, one on either side of the group of male flowers (Fig. 6), the polished surfaces of the walls probably reflecting a certain amount of the light admitted. The whirling of the flies in their frantic efforts to escape fills the chamber with clouds of pollen dust and the flies themselves are covered with it. The valve soon after breaks down and out go the flies with the new pollen only to enter another flower and effect the task assigned to them by Nature.

The *Cryptocoryne* are more or less aquatic, or amphibious plants, and according to the species may be partially submerged when flowering or, as is the case with some less aquatic species, a greater portion of the reproductive chamber may be hidden from view. The flowers are produced deep in the axils of the leaves and consequently become slightly compressed. The windows are produced on the 'shoulders' of the chamber which are not covered by the petioles.

In both *Ceropegia* and *Cryptocoryne* the reproductive chamber would be positively dark, but for the fact that Nature has provided 'light-windows' in each case. In *Ceropegia* the position of the 'window' varies. In some species there exists a light-coloured ring around the top of the chamber, in others the ring of light is below, and in such a position as to light up the corona, while in yet others the 'windows' form longitudinal 'pannels' composed of dense and thin bands of tissue to admit light. Whatever may be the type of lighting arrangement, it is so constructed as to illuminate the *corona* in *Ceropegia* and the male flowers in *Cryptocoryne*. The accompanying drawing will explain the subject matter more explicitly than my pen.

EXPLANATION OF PLATE.

Fig. 1.—Flower of a *Ceropegia*.
Figs. 2 to 4 show various types of lighting.
Fig. 5.—Pollen-masses.
Fig. 6.—'Flower' of *Cryptocoryne*.
Fig. 7.—'Window' of *Cryptocoryne* enlarged.
(*The figures are somewhat diagrammatic.*)

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. St. J. Macdonald,

(*With 5 plates and 1 text-figure*).

(*Continued from page 59 of this volume*)

Part V.

The Mahseer in Burma.

Oh! Scaly monsters of the deep, or of the turbid stream,
Reveal your secrets now and then, and fulfil the Angler's dream!
Why do you accept my bait one day, disdain it on another?
Though light and shade prevail the same, please what's the secret khubbar?

I cast my spoon and hide from sight, the same from day to day.
Sometimes you take it at my feet, anon just swim away!

Large sums I spend on rod and reel, all to beguile and fight,
Hundreds of miles I go in search, to test your strength and might.

Into the bowels of the Himalayas, to Burma, Assam, Mysore,
And barren mountains and waters small, Quetta, Banu, Tor.

Then to Trap Rock and Tiger Land, where only gram you take,
Raipur, Saugor, Seoni, in Tapti Sone or Berach.

Pride of place in my heart I give, to your Ava cousins all,
Be they monsters of the Mali H'ka, or Barilius Bola small.

Long may your secrets remain your own, and long may your haunts prevail,
For this after all is the fun of the chase, to find you, lure you, then fail!

A.M.

The Chindwin (1), The Irrawaddy (2), The Salween (3), Tenasserim (4), Size of Mahseer (5), Burma Record and Record Mahseer (6), Varieties of Mahseer (7), Golden Mahseer (8), Thick-lipped Mahseer (9), Black Mahseer (10), Copper Mahseer (11), Chocolate Mahseer (12), Red Mahseer (13), Points to remember when fishing (14), Best season for catching fish (15), Fish destroyers (16).

Fishing Small Streams in Burma. Isolation not a factor (17), Tackle (18), Summary of a Fishing trip in 1928 (19), Notes from Myitkyina and Seniku Fishing Notebook (19), Bait (20), Fishing conditions (21), Tackle (22), Quotations from Notes (23), Big Fish (24), A comparison of the Mali and N'Mai Khas (25), List of fishes to be caught (26), Extracts from the Myitkyina Fishing diary (27), Extracts from the Seniku Fishing Diary (28), More extracts from the Myitkyina Fishing Diary (29), Notes on the Mali K'ha (30), Notes on the N'Mai K'ha (31), Notes by Capt. Finch (32), Myitkyina Fishing Association (33), Mr. T. P. Dewar's notes (34).

The Mahseer in Burma.

In devoting a special chapter to Burma I do so with recollections of perhaps some of the finest fishing waters in the Indian

Empire, for they hold a variety of mahseer the study of which affords a most interesting subject. As a province it is, with Assam, the best and most adapted to the mahseer. This is on account of its net-work of rivers, forest clad, and for the most part unmolested by the ravages of man or beast. Sir George Scott writing in his book *Burma and Beyond* says:—

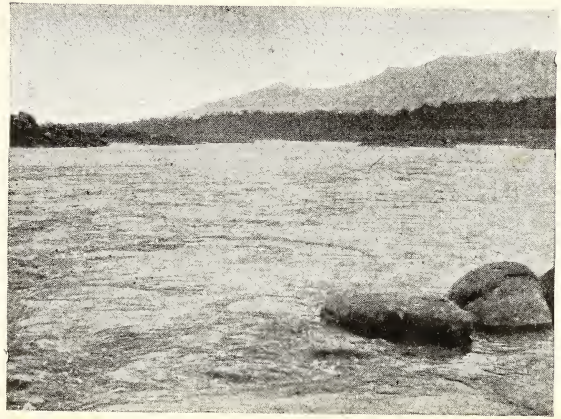
> 'From the stretch of hill country between Assam and China a number of mighty rivers start to run southwards in nearly parallel courses. They supply all the water that is wanted for cultivation and irrigation in Indo-China. They begin near one another in a very narrow span of longitude, and gradually spread out in a fan, which covers the lands from the Yellow Sea to the Bay of Bengal. All of them run in deep narrow rifts, and the ranges which separate them go on running southwards almost as far as the rivers themselves, and in China almost as sharply defined as the river Channels.'
>
> 'These mountain ranges fall away from each other as the river valleys widen, and they lose their height as tributary streams steadily cut through the ridges which form herring-bone spurs and spines. But they still keep the same north and south direction, though here and there spines re-enter and form the series of flat-bottomed valleys and wide straths which make up the Shan States.'
>
> 'Of all these rivers the Salween most steadily preserves its original character, for it flows swiftly down in deep channels, sometimes precipitous gorges between high cliffs, from its source till it reaches the plain-land, which it has itself piled up over the sea in the course of ages. It runs down the centre of the British Shan States, and these lie towards the fringe, and nearly in the centre of the fan, which has for its ribs the Brahmaputra, the Irrawaddy, the Salween itself, the Mekhong and the Yangtzu.' The chief rivers in the north are the Chindwin on the west, the Irrawady in the centre and the Salween to the East, with the Tenasserim in the South.

1. *The Chindwin.*—Fed from the west by the Manipur river and its smaller tributaries and from the east by the Uyu and its many affluents, all of which hold mahseer; for some unaccountable reason the fish of this river are reluctant to take spoon or spinning bait. This has been the experience in the past, and it must for this reason alone be classed as an indifferent fishing river below Homalian. In the Hukawng valley, where the Chindwin rises, the fish run large and are game, taking spoon readily; the upper reaches of the Uyu, coming from Mogaung and Karmaing in the Myitkyina district, also afford excellent sport.

The circumventing of the fish in the Chindwin is an unfinished study in the case of the western rivers, though not to such an extent with the eastern tributaries.

2. *The Irrawaddy.*—Roughly dividing Burma lengthways has some 700 miles of course before it empties itself into the sea below Rangoon. It becomes the Irrawaddy 29 miles above Myitkyina, the most Northern district of Burma, where two rivers of equal size, the Mali and N'Mai H'ka come into confluence, forming a picturesque junction and an angler's paradise. The fishing water may be roughly defined as being above Katha. It is not really good till Bhamo, but is par-excellence above Myitkyina whence, from the confluence of the Mali and N'Mai H'ka to Fort Hertz up the Mali, and H'Tawgaw up the N'Mai, there is approximately 120 miles of water on each of these rivers. Fish run to any size, and many a monster is to be seen cruising in the backwaters of the Mali from the road above at Teing H'ka. At the actual confluence I have taken a 75 pounder and fought for two hours with another monster and then lost him. In the Myitkyina District there are numerous

1. A panoramic view of the famous confluence looking down from the bungalow.



2. Famous rocks 22 miles north of Myitkyina.

3. Mali Rapid into confluence F—G is excellent water.

large spring-fed rivers that make excellent junctions with these two rivers, the Mali and N'Mai, and some wonderful bags have been made in the past.

3. *The Salween.*—This great river, which is navigable for hundreds of miles inland, is hardly touched on in any books as a fishing river. I here again quote Sir J. G. Scott from his book :

> 'The Salween is one of the most astonishing rivers in the world. Its sources are not accurately known, and throughout its whole course, in British territory at least, it preserves the character of a gigantic railway cutting or canyon. Though it runs from North to South, it has a variety of bends that prevent any very long view up or down its course. The banks rise to thousands of feet on each side, and often so sheer from the water's edge that there is seldom room for any sort of camping ground on either side. In the dry weather there are what may be called 'bays' of blinding white sand, or a chaos of huge boulders strewn broadcast; and here and there, where a tributary enters, a stretch of pebbly gravel. The rocks are of the hardest kind, siliceous and even vitreous, and yet they are ground and scored by the stones borne down by the current. The rocks for the most part are coated with a glistening polish, as if they were black-leaded, and when it is considered that the sun can only shine down into this great gorge when right overhead, and that blankets of mist lie over it every morning, its austerity may be imagined'.
>
> 'A feature of the Salween is the extreme coldness of its waters, partly caused by the melted snows coming down from the sources, but partly also because of the lack of sunlight. In the cold weather the mist hangs over it densely like a blanket, but in the hot weather it rises half-way up the hills, and remaining there produces the phenomenon of sunshine above and a clear atmosphere over the river bed. This blanket of fog is found by aneroid to measure a thousand feet with a clear atmosphere above and below'. The average difference between high and low water in the Salween level is sixty or seventy feet, and in some places as much as ninety feet. There are many rapids in the current, and many reefs of rock running across . In the time of high water all beaches and boulders are lost, and the water actually laps the steep slopes of the forest. The current varies extremely; there are sluggish reaches, and then races. Native boats at certain seasons of the year can ply on it, but continuous navigation for any length would be impossible.'
>
> 'There are many ferries for traders at various points, but in some the ferry-men live in villages high up on the hills above, and the steepness and the absence of proper landing-places make the working of these ferries both difficult and erratic.'
>
> 'The drenching mists would lead to fevers and ague, it might be supposed, but the Red Kerens, and others who live in the District, seem to be immune, from long acclimatisation.'
>
> 'At five miles below the Keren-ni border the busy part of the river begins, with the Ta Taw Maw ferry, and from here the river is a regular trade route down to Moulmein and the coast.'

There is little to be desired more than this as a fitting description of ideal mahseer water. Whether it is because the higher reaches of this river traverse wild country out of the beaten track of the 'White man', or because of lack of enterprize by residents of the neighbouring stations, I have found it difficult to get in touch with any one who has fished it, or knows anything about the fishing this river offers; but that there are huge mahseer in it, is certain. A correspondent writes me that a nephew in the Bombay Burma Teak Corporation told him of having seen shoals of masheer 6 ft. in length cruising at certain places in the lower Salween, on the Siam Border.

The rivers coming in on the left bank from China should certainly hold mahseer, even though the rivers coming in on the right bank from the Shan States are almost denuded of fish life by the extensive irrigation. This appears to have been the experience of most anglers posted in the Shan States: and we read in 'The Mighty Mahseer' that it is hardly worth wetting line in any of these rivers. An illustration of what poaching and extensive irrigation will do.

4. *Tenasserim.*—In the south this river has afforded excellent sport and the rubber planters have made some big bags. Trips are made by motor launch into the higher reaches where large fish of 50 or 60 pounds have been taken so that, generally speaking, we might justly conclude that the Mahseer is common throughout Burma; and one can reasonably expect to find him in any perennial stream which is rocky and rises in hills, irrespective of where it joins the larger rivers. As an illustration of this see Sahmaw Chaung further on in this chapter.

5. *Size of Mahseer.*—To what size we may expect fish in a river depends largely on the size of its waters. The larger the river the bigger do fish run.

The limit of the size a Mahseer attains is put at nine feet.

6. *Burma record and Record Masheer.*—The best taken to date in Burma is 92 lbs., caught two miles below Myitkyina and a souvenir of the fish was in the Myitkyina Club. The record Masheer caught on rod and line is 119 lbs. This was taken in Mysore; it was 64 inches long and had a girth of 42 inches.

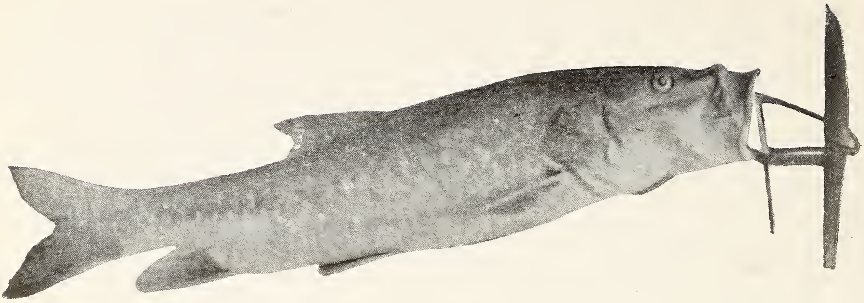
That this grand fish can be beaten in Burma I am convinced. I have myself seen fish nearly 6 feet long at Tiang-Kha, 40 miles north from Myitkyina, that must have been 150 lbs. At the confluence of the Mali and N'Mai Rivers also, I have seen fish rise that were 18 inches across the back, if an inch. This much suffices then, to show that we have in Burma Mahseer as large as anywhere else in the Indian Empire.

7. *Varieties of Mahseer.*—Burma in particular is fortunate in offering opportunities for studying the much neglected subject of the varieties of mahseer. Thomas in his 'Rod in India' of 1873 invited the attention of anglers to this study. To give up catching fish when they are on the feed, and write down copious notes and details of an unusual fish is not a very interesting occupation, still it is time well spent, and invaluable to Natural History. By doing this in 1928, I was able to open up the question of whether there are not at least 6 distinct varieties of mahseer to be caught. The photographs contained in this chapter show the difference but they are not conclusive enough. If anglers would only further note down the colourings and different characteristics of such fish, we may prove this by specimens packed and forwarded to the Bombay Natural History Society. (See specimen form elsewhere.)

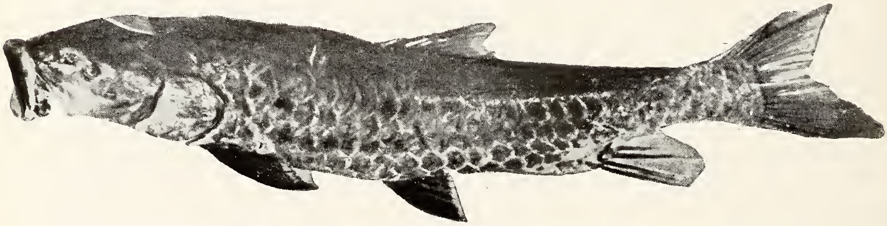
The six types of Mahseer that I caught are as follows; and though they differ all fit Doctor Day's *Barbus tor* in the main points.

8. *The Golden or Himalayan Mahseer* is the commonest and the same as the Indian fish, which are represented by two forms:—

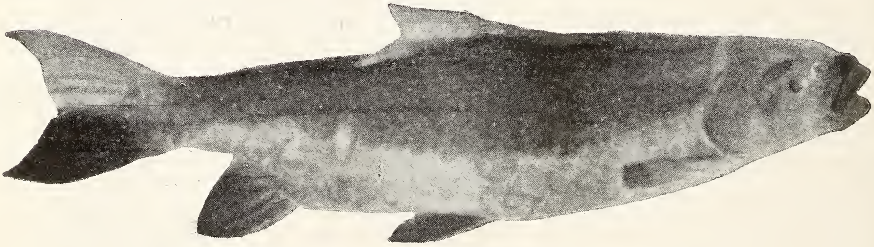
(*a*) Golden Mahseer. The Putitor Mahseer, *Barbus tor putitora* (Hamilton) known in Assam as the 'Greyhound' fish. It is usually long and narrow, with a distinct black line down his entire length, two and a half scales in width above the lateral line, head large and long, top half green, lower half pale green running into silver.



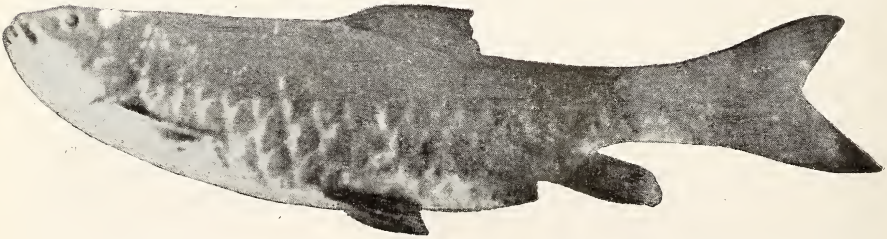
1. Golden or Himalayan Mahseer, *Barbus tor putitora* Hamilton, 23 lbs. Because of its long body referred to in Assam as the Greyhound type.



2. Black Mahseer. A colour variety of the Putitor or Golden Mahseer.



3. Chocolate Mahseer, *Barbus* (*Lissochilus*) *hexagonolepis*.



4. Red Mahseer. Another colour variety of *Barbus* (*L.*) *hexagonolepis*.

Above lateral line from golden with a mauve tinge on silver grey background. Fins blend with colouring; dorsal green and dirty pink, ventral and pectoral pale green to olive with red fringe. Eye: iris golden, pupil black. Belly white.

(*b*) The Tor mahseer, *Barbus* (*Tor*) *tor* (Hamilton). This is rather uncommon, and is generally taken with paste or dead bait, fishing on the bottom. The head and mouth is smaller, and body deeper than in the first type, the colouring is much the same as the first type. See photos opposite. The scientific names have been adopted from Dr. Hora's article *Game Fishes of India*, from the *Bombay Natural History Society's Journal*, Vol. xli, No. 3, page 521 dated April 1940.

9. *Thick-lipped Mahseer.*—The thick-lipped mahseer has the same colouring as the Himalayan mahseer differing only in the head. Chief features are the thick lips with the adipose extension. Hora classifies this fish as a variation of the true *putitor* mahseer, the development of the lips not being as yet cleared up.

10. *The Black Mahseer.*—Two distinct types are taken. (*a*) Is stocky in build, head small and black, mouth small, barbels and eyes black. This fish is marked by a jet black line two half scales above the lateral line; scales above lateral line have a tinge of gold on the scale tips running to jet black on the back. Below lateral line scales are lighter but dirty white, almost shot black to the scales on the belly which are dirty white with a black fringe. Fins black with grey at base. It is fairly common in the streams which are heavily wooded, and is almost without exception a very game fish.

(*b*) Is a melanic form of the *putitor* mahseer.

11. *Copper Mahseer.*—The copper mahseer is quite the most beautiful fish I have seen. He is bright copper all over with a sheen running into all the colours of the rainbow, he runs from the deepest shade of copper with the delicate mauve sheen throughout, to the more delicate shades of copper with shell pink, on a background of shot silver and gold. The head is small and nose slightly concave, the lips are a modification of the thick-lipped variety. The adipose continuation of the lower jaw is clearly defined, but very much modified and not so pronounced as in the thick-lipped variety. Fins deep blue, except tail fin which has a red fringe. Belly delicate shade of yellow eyes bright copper; pupil deep indigo blue. Only three of this variety were caught in 1928 at the confluence of the Mali and N'Mai Rivers; best fish weighing 25 lbs. no black line down the side.

12. *The Chocolate Mahseer.*—Head round and square and small like a *Labeo*, colour bronze, running through delicate shades into purple. No black line above lateral line. Above the lateral line chocolate running into blue to dark chocolate on the back, with polished bronze tinge to scale tips. Below lateral line, running from faint silvery blue to white on belly to the extent of three complete rows of scales, with half row on either side, clearly defined, making four. Bright orange spots under lower jaw on chin; lips thin, mouth small. Fins sky blue; iris chocolate; pupil black. Two fish of this kind taken, best 28 lbs. taken also at the confluence of the Mali and N'Mai Rivers.

13. *The Red Mahseer* has a round and small head, top of which is shot gold and purple, also gill plates; mouth small. Above Lateral Line, beautiful sea green shot with silver, tips of scales salmon pink. Below Lateral Line, mauve with silver, vermilion tips to scales; belly pink, fins all bright red; black line above the Lateral Line not present in this fish. Eye golden, pupil indigo blue. Took five of these fish at the same confluence, best 18 lbs.

A study of the photographs will convince anyone interested, that these fish bear marked differences to each other both in colouring and shape. This is of no value to piscatology, but if fishermen are able to differentiate the varieties, my object will be fulfilled; and if further pursued, by specimens being sent to Bombay, we will have at least opened up this neglected but interesting study.

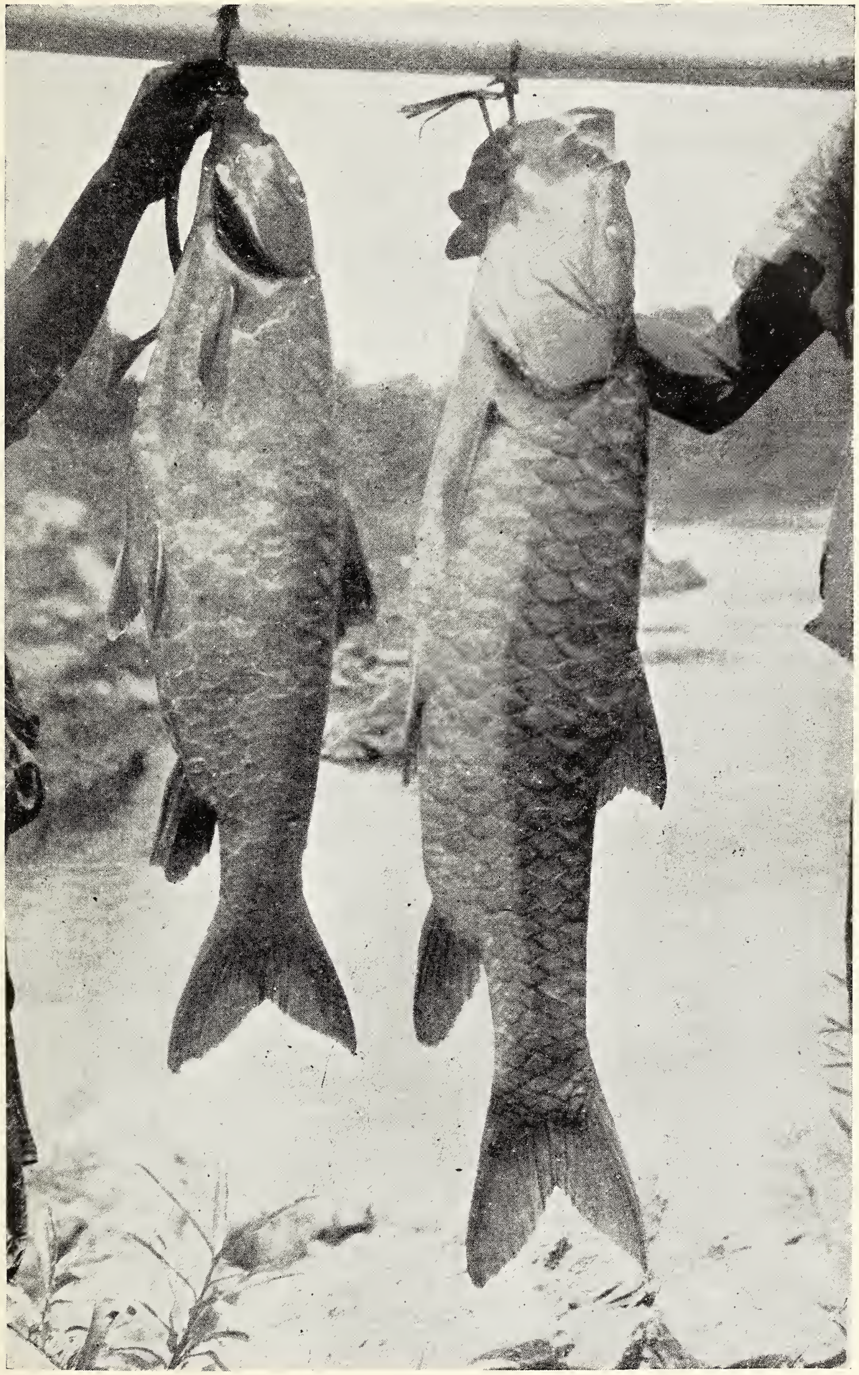
From the recent work by Dr. Sunder Lal Hora, on the Game Fishes of India, appearing in serial form in the *Bombay Natural History Society Journal*, and from correspondence I have had with him, he has identified these fish as follows:—

The Chocolate Mahseer ...	*B.* (*Lissochilus*) *hexagonolepis* (McClellan) only colour forms.
Stocky Black (*a*) ,, ...	
Red ,, ...	
The Golden Mahseer ...	*B. tor putitora* (Hamilton). The hypertophied lips being only a peculiarity, not yet fully investigated.
The Thick-lipped Mahseer.	
The Black (melanic) (*b*) Mahseer ...	
The Copper Mahseer ...	*B. tor mosal* (Hamilton).

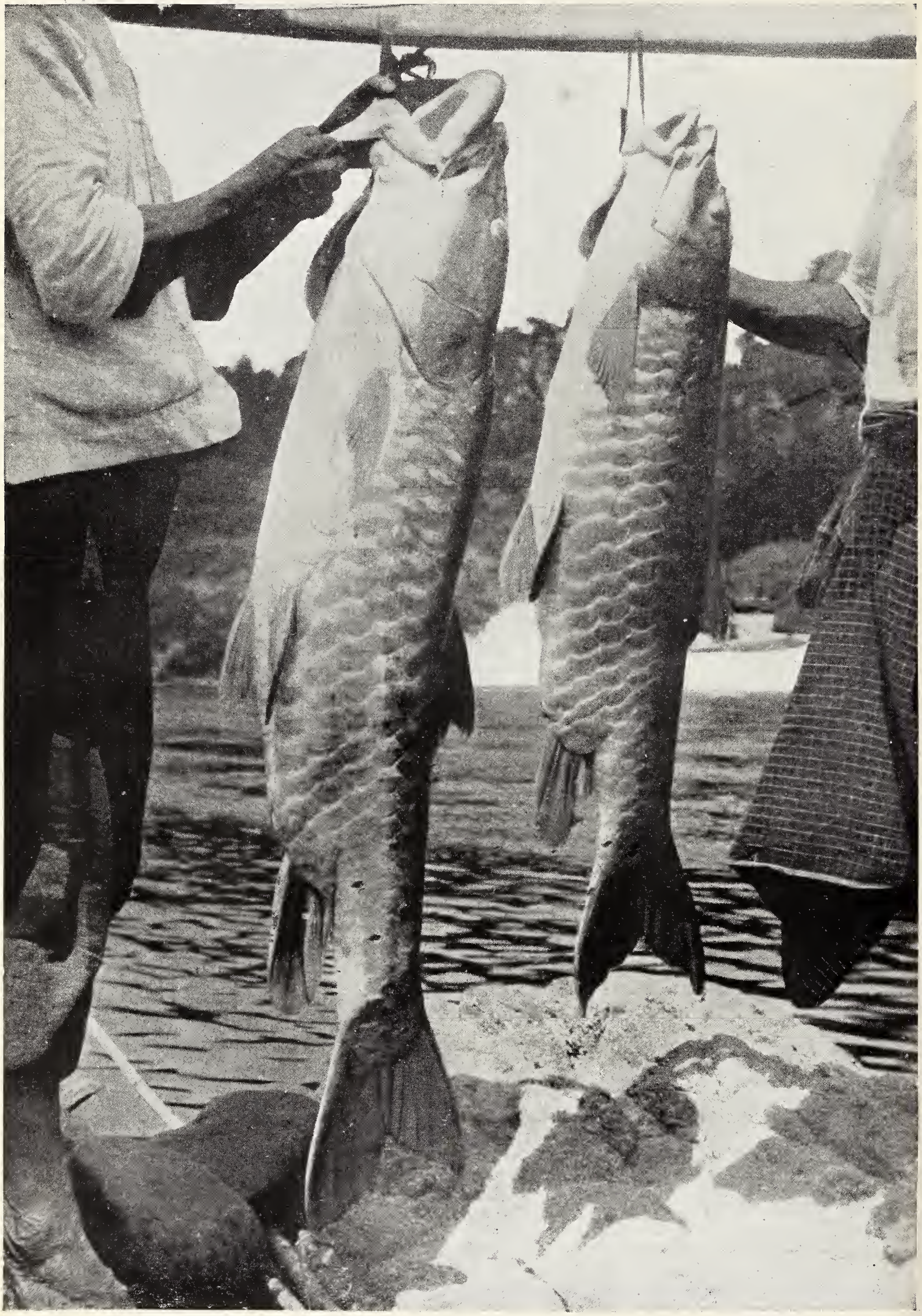
14. *Points to remember when fishing.*—Mahseer which have not been 'educated' by wielders of the spinning rod are not, so far as my experience goes, shy or difficult to catch; so we need only follow the usual rules of fishing, to be successful. There are, however, one or two points of importance which, if mentioned elsewhere, will also bear repetition here, as being of special value while fishing in Burma, where the dense forest that grows to the water's edge of most of the rivers supplies various leaves, fruits and vegetation to form a diet to which these fish seem particularly partial. The large jungle figs, so abundant at certain seasons, are much sought after; also the larger forms of insect life.

In the matter of spoon, fishing deep meets with success; in fact it is only by so doing that one hooks the really big fish. The use of as fine tackle as is compatible with the size of the fish, combined with the least conspicuous mounting and hook arrangements, amply repays the careful fisherman in these gin clear waters.

15. *Best season for catching fish.*—The general idea of the autumn and spring being the best seasons does not appear to fit most of the rivers of Burma. This is also the case in Assam. Langley's famous catch of 1400 lbs. of mahseer in two days was made in November up the Mali H'ka, and good bags have been made by others at the same season. It is interesting to note that these cold weather catches have all been made at the junction of spring-fed rivers, with the N'Mai H'ka and the Mali H'ka, both of which are snow fed, and probably connected with the winter spawn.



Left. Chocolate Mahseer, *Barbus* (*Lissochilus*) *hexagonolepis*, 16 lbs.
Right. Golden Mahseer, *Barbus tor putitora*, 23 lbs.



Left. Thick-lipped Mahseer, *Barbus tor putitora* Hamilton.
Right. Copper Mahseer, *Barbus tor mosal* Hamilton.

Note the pronounced adipose extension of the lips in the larger fish. It is a peculiarity not yet fully investigated.

16. *Fish destroyers, Crocodiles and Turtles.*—The upper reaches of the Irrawaddy from Bhamo are free from crocodile and turtles, and the fish are assured this much immunity in having nothing larger than the otter to destroy them. This is a curious situation, and rather unaccountable as the Mogaung and Namyin, and the Uyu are all large, sluggish rivers, with rocks and sandy beds, especially adapted to these fish-eaters; game also abounds for the mugger in the dense forest that grows down to the banks. Long may this remain foreign to these pests.

The upper waters of the Chindwin also, I understand, are free from the crocodile, and the turtle is rare, though one was caught on a Victor rod by Mr. T. P. Dewer in the Hukawng valley, 87 lbs., while fishing with a spoon ! !

Otter. Otters abound and there is hardly a stream free from them. I have seen schools of as many as eleven, hunting together in small streams. They occasionally damage large fish, and are besides Man, practically the only destructive creature in these waters.

Man. Even in Man we may count our luck as being well in, for the best fishing water in Burma is undoubtedly in the Hill tracts. These are administered by the Burma Frontier Service, whose officers are both policeman and magistrate. No settlement is allowed in these tracts by our Aryan brethren, so the country remains unspoiled and wild. Long may the policy last.

I refer to Kachins chiefly, who fortunately for the fish are a lazy easy-going people, and slow at exterminating fish. They have their primitive methods of trapping, shooting with arrows, cutting with *dhas* by night with the aid of flares, even poisoning the fish, but with all this, are not nearly as destructive as the fishing classes in India, who deplete a river in a short time. In some streams fish are partly protected, by the local *Dewar,* or chief of a group of villagers, who allows trapping to be done only after permission is obtained, or when he has a feast. So long as these Hill tracts are not thrown open to colonization, we may hopefully expect to see mahseer remain in the same great numbers as at present.

FISHING SMALL STREAMS IN BURMA.

There is abundant opportunity for the Angler who wishes to try Fly, or Fly Spoon, in the innumerable small streams that drain this forest clad land.

In fact, almost any stream, however small, will hold Mahseer and Trout (*B. bola*), provided it rises in the hills, and is perennial. It seems immaterial where these streams meet the larger parent rivers, or whether the bed is shingle or sand, fast or sluggish.

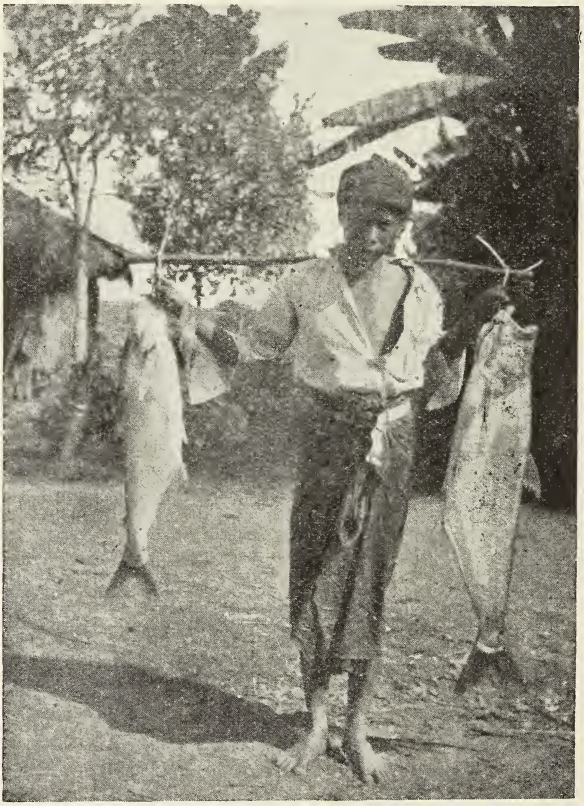
Let me here describe just one such stream. I will take as an example the Sahmaw Chaung, in the Myitkyina District.

I was resident on Finlay Fleming's Sugar Estate for 4 years. It was then in its embryo stage; I was employed in the process of opening up vast areas of grass land for sugarcane cultivation, so I was able to study the river fairly thoroughly. I had some

200 mahseer, ranging from 4 lbs. to a ¼ lb., protected behind my bungalow, under a large concrete bridge. These were fed daily, and fishing was forbidden for a distance of 300 yards above and below.

This little burn is no more than 15 miles over its total length, and about 10 yards across at its widest part, and is nowhere over its whole length more than 8 feet deep. The drop is considerable, and it is consequently a series of shallow runs and pools, varying in depth from 3 to 6 feet.

The bed is shingle with small boulders 18″ in diameter and the water gin clear. The banks, for the last four miles of its course, and where it flows out into the valley are covered with high grass (*Saccharum glumeosum*) known locally as *Kaing* grass, but better still as tiger or elephant grass, growing about 12 ft. high.

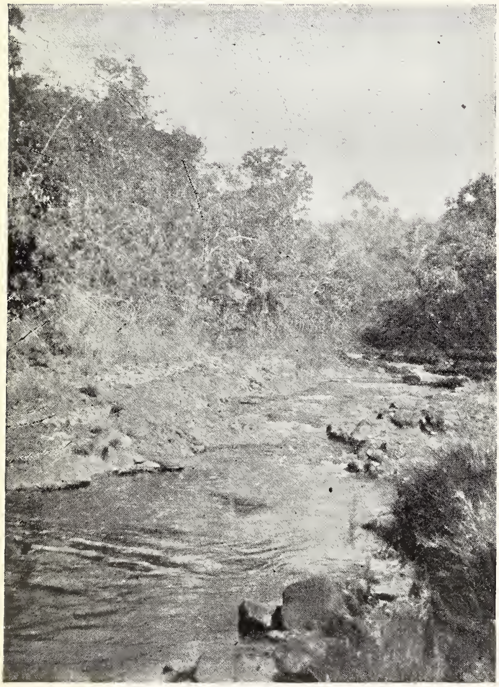


Two good Silund (*Silundia gangetica*) taken at the mouth of the Namti H'ka: 22 and 15 lbs.

I have taken Mahseer up to 7 lbs., out of this little stream, and *B. bola* of 3 lbs. It is full of fish, and a dozen or so small mahseer may be taken any day, over a couple of miles of water.

THE SAHMAW CHAUNG.

1. View through Finlay Fleming's Estate.



2. Hill section, holding fish from 8-10 lbs.

3. Another view of Hill section Typical *B. bola* wate

B. bola of good size and in plenty, may be had over the whole stretch of river.

I give below two specimen days, with these fish :—

Date	*Fish*	*Bait and Tackle*	*Remarks*
12-4-1925	3 . 2 . 2 . 1¾ . 1½ . 1½ . 1¼ 1¼ and 6 others = 17 lbs. Mahseer	¼″ copper and silver Spoon	Salt lick. Fished all day. Put 6 back.
5-7-1925	3. 2 . 2 . 1½ . 1½ . 1 . 1 . 1. and 24 others = 19 lbs. *B. bola*	,,	Below North alignment from 9 a.m. to 11; put 18 back.

17. *Isolation not a factor.*—The interesting feature about this little stream lies not so much in the fish it holds, as in its isolation and distance to the nearest Mahseer water. The Sahmaw stream flows into the Namyin Chaung. A slow sluggish river with a sandy muddy bed, draining the Mu Valley for 40 miles or so; and emptying itself into the Mogaung River 20 miles from where it takes in the Sahmaw Chaung. Over the whole length of its course it is free from rapids, and has no mahseer. The Mogaung River is a very considerable stream, but is also muddy and sluggish, and has no rapids or runs for 30 or 40 miles from where the Namyin joins; so that this colony of mahseer, in the Sahmaw Chaung, is isolated and is at least 50 miles from the nearest suitable water, with no other smaller tributaries in between.

I deal with this at length, in order to illustrate the possibilities of fishing in the many similar streams found in Burma. There is of course no doubt about any small streams that run into the rivers in the Hill tracts, as these are bound to hold fish.

It is interesting to note that in the hills, where the Sahmaw Chaung runs through a small defile, two or three large pools have formed in which can be seen from above fish of 15 lbs. or more. It would be most interesting to know the age of these fish, as their size is out of all proportion to the size of the stream. They are resident there at all times of the year.

18. *The tackle* is the same as for all light fishing, but the lighter the gut and smaller the spoon, the better. I found 3x gut and a ¼″ Fly Spoon answered best. Fly took well, but did not give the good results of the Fly Spoon, with either *B. bola* or Mahseer.

A chapter on Burma cannot be considered complete, without some reference to the famous 'Confluence' and to the water above Myitkyina.

I have included in this chapter notes from my own diary, with a summary of my bag, not with any object of exemplifying my results, but to illustrate to the would-be visitor what he may expect. For although this is wonderful water, it is by no means easy, nor does the reel sing at every cast. These are results of 10 hours of hard fishing daily.

For the condensed notes of the fishing round Myitkyina, I am indebted to Capt. Finch, who put in a great deal of hard work compiling them, when Hon. Secretary of the Club. They give anyone interested, all the details required, and should the reader wish to satisfy himself further, of these two famous places 'The Confluence' and 'Seniku', I can only suggest his getting Sheets 92 to G/6, and 92 G/14, scale 1 inch to a mile, obtainable from the Government Map Depot, Calcutta, and studying these with the notes.

It is to the co-operation of anglers in making notes in the fishing books at these places, that we owe all this interesting data.

A great pity it is not done more by station clubs, all over India.

TRIP TO CONFLUENCE OF THE MALI AND N'MAI K'HAS, 1928

Date	*Summary of Bag* *Locality*	*Weight*
11th April, 1928	Confluence	
12th ,, ,,	Rocks	
13th ,, ,,	,,	
14th ,, ,,	Confluence	6, 7, 3.
15th ,, ,,	,,	
16th ,, ,,	,,	25, 30.
17th ,, ,,	Waishi	
18th ,, ,,		
19th ,, ,,	N'Sop Zup.	10.
20th ,, ,,	,,	$4\frac{1}{2}$.
21st ,, ,,	,,	26.
22nd ,, ,,	,,	
23rd ,, ,,	Tiang Zup.	
24th ,, ,,	,,	12.
25th ,, ,,	N'Sop Zup.	
26th ,, ,,	,,	
27th ,, ,,	Confluence	75, 10, 48^{a}, 3.
28th ,, ,,	,,	28, 6, 3, 3, 2^{b}, $1\frac{1}{2}^{c}$, 1^{b}, 1^{b}, $\frac{1}{2}^{b}$.
29th ,, ,,	,,	12, 13, $17\frac{1}{2}$, 18.
30th ,, ,,	,,	44, 25, 5^{b}, 4^{b}, 2^{c}, $3\frac{1}{2}^{c}$.
1st May ,,	,,	23, 10.
2nd ,, ,,	,,	28.
3rd ,, ,,	,,	50, $18\frac{1}{2}$, 42^{a}, 34, 1^{c}.
4th ,, ,,	,,	23, 16, 12, $1\frac{1}{2}$.
5th ,, ,,	,,	
6th ,, ,,	,,	27, 24, 14.
7th ,, ,,	,,	21.
8th ,, ,,	Rocks	21, 15, 9, 6, 6.

These include Mahseer and other varieties, [7]Butchwa, [2]Goonch and [4]*B. bola*[2].

53 fish weighing 861 lbs. giving an average of 16·25 lbs.

The best day 3rd May. 5 fish weighing $145\frac{1}{2}$ lbs.

The 4 best fish 75, 50, 48, 44 lbs.

[2] Goonch = *a*.

[7] Butchwa = *b*.

[4] *B. bola* = *c*.

SEASONS.

Up to date 1932.

19. *Condensed notes from the Myitkyina and Seniku Fishing Note Book.*

(*By kind permission of the Hon. Secretary Capt. Finch and members of the Fishing Club.*)

Mahseer have been caught in every month of the year, but undoubtedly, both in the Mali and the N'Mai, the most promising seasons are from late in February until the end of April or the middle of May, (depending upon the incidence of heavy rain) and also parts of September, October and November. The majority of big fish have been accounted for from the upper Mali in the Autumn, and from the N'Mai in March and April during recent years. The earliest in the year that a catch is recorded is 13th January. One enthusiast landed fish in July and August, and accounted for a couple on 30th December, but this may be regarded as somewhat exceptional.

During the Rains, tributary streams give some sport with small fish, both fly-spoons and flies being successful.

In the Autumn, much depends upon the state of the water, a paucity of rain being conducive to sport with really large Mahseer.

20. *'Baits', etc.*—The most satisfactory 'weapon' for these waters is the Spoon. Opinions differ, of course, as to the size and type of spoon which is most killing. A copper and silver spoon of almost any shape, mounted with a flying treble hook is recommended. Two experts, whose names figure as the captors of numerous monster Mahseer, employed home-made spoons not exceeding about two inches in length. Many useful fish have been landed on spoons of four inches and over.

(The writer landed a 65 lbs. on a 1¾-inch spoon, and a 1¾ lb. on a 3-inch spoon from the same rapid, and the only things that he has hooked on 4-inch spoons during hours of spinning are:—(1) a submerged cabbage, and (2) portions of Asia. Chacun a son goût.)

If fish are feeding or inquisitive they will take anything, even discarded cheroot ends. Prior to 1914, success was frequently achieved with dead bait; live bait has also been used, and these should be resorted to when the water is very dirty and spoons have failed to attract.

Flies and fly-spoons have sometimes given amusing sport in tributaries. In certain places, wild figs, pieces of leaf and those cheerful little insects called by the Burman 'payit', fished near the surface, have caught small Mahseer. 'Phantom' minnows have not proved a success in these waters. The record Mahseer for Burma was taken bottom-fishing with Atta from the Irrawaddy not far from Waingmaw a few miles below Myitkyina.

The 'chocolate' mahseer is partial to a worm!

21. *Conditions for Fishing.*—Mahseer have been caught on bright days, on dull days, during rain, even during thunder storms, before noon, at noon, after noon, and after sunset. At any phase of the moon.

Mahseer can be caught on ordinary tackle in dead clear water, in pale green water, in beer-brown water, in pea-soup.

When the river is high, when it is low, when it is rising, when it is falling. The ideal? *Quien sabe?*

In the Spring, I think, when the water is clearish, not transparent, but translucent to a depth of about three to five feet; then good catches may be hoped for.

In the Autumn, when the sun has had a whack at the water, and the water is rather dirty and falling fairly fast, fish may be hooked, particularly where a tributary adds clearer water to the main streams.

When the temperature of the water is high, fish will be more numerous in broken water and close to falls.

When the water is very cold and clear, a few mahseer can be hooked usually in broken white water.

Fish may really be 'on the feed' for most of the day, or perhaps for only half an hour. No definite rule can be laid down as to the best times for fishing. As an example of the impossibility of knowing whether morning or evening fishing will prove the more successful, the following catch, (from the N'Mai), is quoted:

September	*Morning*	*Evening*
18th. 5 fish	Best 30 lbs.	Not a touch.
19th	Nil.	5 fish, best 20 lbs.
20th 5 fish	Best 49 lbs.	Nil.
21st	Nil.	Nil.

22. *Tackle*.—In the Myitkyina District, the all-round angler should supply himself with an outfit to meet the following varieties of fishing:—

(*a*) Spinning deep in fast water for fish up to 100 lbs.
(*b*) Trolling from a boat or raft.
(*c*) Casting a fly spoon and fly fishing.

(These notes are given as a rough guide, in case they may prove of assistance to anyone who has not as yet fished in the East.)

(*a*) 'Heavy' Spinning:—

Rod:—Should be of Greenheart, split cane sometimes fails in a tropical climate. Length 11 to 12 feet is enough.

Reel:—Must hold over 200 yards of suitable line.

Line:—'Lignum Vitae', 36 lbs. strain, from Manton's Calcutta is good.

Traces:—Strong killin Wire.

Leads:—'Jardine' spinning lead type, up to 1¼ oz.

Spoons:—Get these made from samples by a lohar, or Indian artificier, and mount them yourself with a flying treble-hook. Good types:—(all obtainable from Manton & Co.).

Name	*Colours*	*Sizes obtainable*
The 'Putao' Spoon.	Dull copper and silver.	1½, 2, 2½, 3 ins.
Special Hog-backed.	Gilt both sides best.	Sizes Nos. 4 to 10.
The 'Myitkyina' spoon.	Brass and silver.	Scaled, 4 inches.
Hardy's Hog-backed.	Mahseer.	
Spoon.[1]	Bright gilt and silver.	1", 1½, 2, 2½, 3 ins.

Dead bait tackle.—The Archer Spinner, to take a fish 3 to 6 inches long. Lacy's chilwa tackle.

(*b*) Trolling from a boat for big fellows:—

A Sea Rod about 8 feet in length.
A large reel to carry 300 yards of line, with an extra brake.

(*c*) Fly Fishing:—

Dark coloured flies seem to be the most killing, also white or yellow flies at times. Mahseer will probably take any fly occasionally, Suggested:—Watson's Fancy, Blackamoor, Black Gnat; also

---

[1] A good shape; Hardy's wire mount is unreliable, sometimes fraying through from twisting when a fish is 'on'.

Coachman, Smoky Dun and Yellow Spider, sizes 2, 6, 10; and 12 for barils.

Gut casts as for equivalent weights of salmon and trout.

Accessories :—

One or two intelligent piadas or orderlies: a gaff or landing net is seldom needed.

A Spring balance, to weigh by ½ lb. up to 60 lbs.

A pair of wire-cutting pliers; a small file.

A baiting needle. A tackle box.

Plenty of spares to replace those lost.

23. *Quotations from Notes on Tackle.*—'This fish' (a 32 lbs.) 'fought too much for my split cane rod and it has a bad kink just below the base ring.'

'Have found no line to equal "Lignum Vitae" from Manton' (Sk. P. 211).

'For traces nothing but "Killin" wire . . . For spoons I prefer the old-fashioned bar-spoon.' (SK.P. A.D.).

'Do not have a "triangle" in the belly of the spoon, which may be crushed flat by a fish, resulting in oaths and loss. A fish making an attempt at the spoon will slip on to a single tail triangle and be hooked.

Large mahseer have been caught on the following varieties of spoons :—

1½, 2½, 3, 3½, 4, 4½, 4½ inches copper and silver ;
1½, 2½, 3, 4, 4½ ,, all copper ;
1½, 2½, 3, 3½, 4, ,, brass (or gilt) and silver ;
1¾, 3, 4, 4½ ,, silver.

Spoons of many different shapes, 'mistri'-mado, made by Farlow, Luscombe, Manton, Hardy, etc.

There is so far no record of any mahseer having been hooked on a 'Phantom', 'Devon' or similar toy, in local streams.

Further Notes on *Tackle*; contributed by two successful anglers.

Spoons.—(*a*) 'A two-inch copper and silver spoon, with a treble hook flying mount. I have also found useful a silver and brass about three inches and rather narrow—this in very strong water.'

(*b*) 'I prefer the "Myitkyina" shaped spoon, sold by Manton. . . . . . Dull outside, bright inside.'

Lead.—(*a*) 'I have always used a 2½ oz. lead—triangular shape.'

(*b*) 'I use as much as the rod will stand in most places, and let the lot sink as far as I dare. You lose a lot but it pays: about 4 oz., I think.'

Dead bait.—(*a*) 'Dead bait I have tried on a few occasions with success usually at a junction where one stream was dirty and the other clear. Bait just on the margin of the dirty.'

Line.—(*b*) 'I use waterproofed plaited cutty hunk or similar. Silk is too expensive and rots, breaking strain about 20 lbs. I rub it with Cereline (Hardy's) every day or so and dry carefully every evening. Backing, undressed cutty hunk, very strong.'

24. *Big Fish.*—Undoubtedly the keen angler who is determined to go 'one better' than his predecessors stands the greater chance of landing a record if he concentrates upon the warm waters of the Mali H'ka, or the Mali at the 'Confluence', which have surrendered more fine fish in a shorter period than those of the chilly N'Mai.

Nevertheless, the fortunate fisherman who has worked hard and been blessed with good weather conditions, may hope for a catch from the N'Mai which will rival those given up by the Mali.

For comparison, a list of large mahseer caught from both rivers is given on the next page.

25. *List compiled from notes in the Myitkyina and Seniku Fishing Diaries up to 30th June 1931.*

	Mali H'ka and Confluence						N'Mai H'ka						
Fish weight	over												
	80 lbs.	70 lbs.	60	50	40	Total	80	70	60	50	40	Total	
Prior to 1915	1	...	...	1	...	2	2	...	2	4	3	11	Prior to 1915
1915 Spring	...	...	...	...	1	7	...	...	1	...	...	1	1915
Autumn	...	2	...	2	2								
1916 S.	...	...	2	1	...	(*a*) 18	...	...	...	...	...	...	1916
A.	...	...	...	9	6								
1917 S.	...	2	...	4	...	(*b*) 12	...	...	...	1	1	2	1917
A.	3	1	2	...	...								
1918 S.	...	...	...	1	...	2	...	...	...	1	1	2	1918
A.	...	...	...	...	1								
1919 Spring	...	...	1	1	2	4	Best Recorded 32 lbs.						1919
1920			No Record				...	...	1	...	...	1	1920
1921 Autumn		Bad Year			1	1	Best Recorded 37 lbs.						1921
1922 S.	...	...	1	1	...	3	...	...	...	...	...	...	1922
A.	...	...	...	1	...		...	...	...	...	...	...	
1923 Spring	...	...	...	3	2	5			No Record				
1924 ,,	...	...	1	2	3	6	...	...	...	...	...	...	
1925 S.	...	...	1	1	1	4	...	...	...	...	...	...	
A.	...	...	...	1	...		...	...	...	...	...	...	
1926 and 1927			No Record				...	...	...	...	...	...	1927
1928 Spring	...	1	...	2	1	(*c*) 4	...	...	...	3	2	(*d*) 5	1928
1929 S.	...	...	...	1	1	3	...	...	...	...	1	1	1929
A.	...	...	...	...	1								
1930		Best Fish 30 lbs.					Not fished						1930
1931		Bad season			1	1	...	...	1	...	1	2	1931
Totals ...	4	6	8	31	23	72	2	...	5	9	9	25	Total
Weights over...	80	70	60	50	40		80	70	60	50	40		

(*a*) Includes 6 fish of 50 lbs. and 3 fish of 40 lbs.
(*b*) The 3 fish over 80 lbs. were all caught by L. Lacy Langley.
(*c*) All caught at the 'confluence.'
(*d*) All caught from the Right back 'Triangle.'
The Mali is far more fished than the N'Mai, being more accessible.

A. M.

26. *List of Fish to be caught in the Mali and N'Mai H'kas.* (Will members of the Myitkyina Fishing Association please add to this list any other species caught while angling for Mahseer).

Mahseer (*Barbus tor.*) At least six easily recognisable varieties.

The Common The Thick-lipped The Black	The largest varieties.
The Chocolate The Copper The Red	Small mouthed.

Indian 'Trout' (*Barilius bola*). Reported to weigh as much as 5 lbs. but seldom taken over 3 lbs.

Other Lesser Barils occur but do not exceed a few ounces in weight.

Bachhwa (*Eutropiichthys vacha* (Hamilton). Two varieties, up to 6 lbs. Take spoons of any size, also natural bait.

Goonch (*Bagarius yarcelli*). Two varieties, running to over 150 lbs.

'Kalabanse' (*Labeo calbasu*). (Labeo). Up to 30 lbs. or more; occasionally taken on a spoon.

Silund (*Silundia gangetica*). Run to over 20 lbs., occasionally taken. Taken Silund of 15, 23 at the mouth of the Namti H'ka, they run up to 100 pounds and over and are very game fish.

Freshwater shark (*Wallago Attu*).
Pithecanthropus indicus, sometimes hooked when fly fishing.
Other varieties of Fish caught in the Myitkyina District.

Species	*Weight*	*Where Caught*	*Date*	*Bait*
*The Indian Gudgeon (gobius sp.)	¼ lb.	N'Mai Hka (between Ladai and Chipwi)	July	Worm on No. 6 Limorick

* Entry by author.

27. *A few extracts from the (old) Myitkyina Fishing Diaries.* When to fish. 'My experience has been that the best time for fishing is the afternoon between 2-30 and 6 p.m.'

(Myitkyina book, p. 49).

' . . . . it is worth fishing the Mali however dirty the water may be'.

(P. 57).

Fly fishing. 'Except in the very cold months all rivers in the (Putao) district yield, probably, "B. Bola, Pakan"; and many an evening can be put in at Lungsawt or the Nam Khamti Zup with a small fly-rod: the "black gnat" is, I think, the most killing fly. Have taken as many as 27 of these small fish in one evening and several times over 20.' (P. 43).

'I have found most of the Salmon Flies, about Lake Trout size and smaller, good, noticeably the "Jock Scott!" also the "Butcher".'

In the *Hukawn Valley.*

'In the winter months in the Hukawn I never caught anything big on a fly, but one can get quite a big bag of tiddlers in almost any stream of an evening. For these small fish I found a touch of red or other bright colour *with dark wings* and a fair amount of tinsel, preferably silver, effective.

'Fly fishing for the bigger mahseer commences after about 1st April.

'Generally fished in the evening only and used a single fly.

'My largest on a fly was an eleven pound black Mahseer which put up a very fine fight, landed several five and six pounders.' (With fly.) (P. 76).

Some good catches:—

From the Mali H'ka:—

22-11-16 ... 20 fish weighing 489 lbs. (Langley) (afternoon).
23-11-16 ... 16 fish ,, 387¾ lbs. (Ditto). (P. 38).
14-4-24 ... 12 fish, best 52 lbs. weighing 228 lbs. at Namlang-Mali Zup. (between 11-30 and 4-30 p.m.).

At the 'Confluence':—

April 1928, in one day, 5 fish, best 50 lbs., total 142½ lbs.

From the N'Mai Hka:—

September 1929, in three days, 15 fish, best 49 lbs. (Seniku Book, p. 218).

From the Namli Hka (from Seniku):—

May 1903, in 2½ days, 32 (small) mahseer. (Seniku Book, pp. 76-9).

28. *Brief Extracts from the Seniku Fishing Diary.*

Tumpang Zup. 'Fishing at the junction is not much good after the middle of April as the N'Mai K'ha then begins to come down very dirty. The Tumpang is fishable up to the end of May, though the river is frequently unfishable for a day or two after rain has fallen'. (P. 3, 1900).

This is not in accordance with my experience, I should say when the N'Mai comes down coloured, the mouth of these spring fed rivers should be at their best, I think a visit late April, when the snow water is down the Zup should be excellent, until the monsoon breaks. Fish will then collect in the warm clear water of the Tumpang. 'The fishing in the small streams (Namli and Tumpang)' from 26th April to 21st May 1903 was A. I. Between these dates I got in the Namli and Tumpang 75 fish, total weight 415 lbs. My advice to a successor is:—Be at N'Mai—Tumpang jtn. with good heavy tackle and dead bait on 1st February . . . . 'After February the fishing at this big junction seems very poor and in the first half of April and in March the small streams are poor also. Remember that February is the month for big fish——'. (Pp. 84-85).

(The above is not true of zups up stream from Shingaw.) In April 1927 I got 5 fish in half an hour on a visit by cycle from Tanghpae at the Confluence, I punctured both tyres and the rain had made the road impossible; so I chucked and returned. Heavy rain spoilt the trip. The Mali was coloured when I got the . . . . 23, 17, 17, 12, 11.

Chipwi Zup :—'Tried the river on 1st and 2nd November, (1918) but saw and touched nothing. It is obvious that I have missed the Autumn fishing: anyhow in places north of the Tunpang-N'Mai junction.'

'At Chipwi on 13th March I found the temperature of the water of the N'Mai Hka 60 degrees, and of the Chipwi itself 64½ degrees, astonishingly high temperature as compared with 50 of the Chenab river where I killed 11 fish in one day last December.' (P. 182, 1919.)

Conditions :—

'The fish were landed under weather conditions varying to such an extent that there can not be any hard and fast rule about feeding fish.' (P. 203).

29. *Brief extracts from the Myitkyina Fishing Diary.* (1915-31).

Near Putao. 'A nice hack out to Maneu village leaving Putao about noon arriving Maneu 1.15 p.m. Troll 1½ miles down stream to a deep still pool—the river down as far as this only yields Pangyin, but there must be some good fish in this pool. I took one of 57 lbs. out of it and have had several runs from big fellows—right in the centre between the 2 rocks is the place they lie. You can get back to Putao in comfort by 7 p.m. "The Namlang-Mali zup needs no eulogising, it is a first rate spot-get about 50 yards up the Mali and your spoon into that smooth Triangle" if possible.' (P. 42.)

'About ½ a mile above the Kankin pagoda there is a big pool near a lot of rocks—a small pagoda on one of them. I lost a monster here which I had played for nearly an hour. I am certain there are big fish in it.

'Another good spot where I lost a big fish is about a mile below Nam Sati.' (P. 49).

'On the 18th March I caught a 47 lbs. and 60 lbs. in the pool "(Namlang)" before 10-30 a.m. The 60-lber I got on casting where the water begins to gather speed and though I breaked as hard as I could. I could not keep him off the silk backing which broke. As I looked at the end rushing through the rings I felt a tug again on the rod. The end of the line had caught in a snake ring I had put on the night before. I put the rod down hurriedly and jumped into the water and got the line, calling to the Shan to hold it while I put it through the rings and tied it round the reel above the backing. This took about 20 seconds (?) during which time the Shan said the fish had gone, but on reeling in a yard or two I found him still there and eventually coaxed him into slack water. He took more than his 60 minutes to bring to gaff. The line must have given at the very end of his rush and he must have turned because he was in very swift water. Both these fish I got on with a silver-copper 3-inch hog back spoon."

'Newnkhai, was taken in "Pickthall's Pool" by a fish which took out 250 yards line at first rush and smashed me at the drum. I breaked with fingers on line drum and was badly burnt.

'I have tried "Langley's Pool" many times but have never touched a fish there.' (P. 57).

From the Confluence. 'The N'Mai I tried on three days and had no luck in it; it is so very much colder than the Mali Hka that the chance of doing really well in it is small.'

The 'Confluence' :—'I lost a number of strong fish, one of them taking 200 yards of line up stream where I was unable to follow him. I had on also a large fish from 6 p.m. to 7.45, which twice taxed my last few coils of line on the drum of my reel. The main spring broke in his second rush. . . he made another rush for the actual zup, when the reel jammed and . . . lost the fish.

The fish took us 400 yards down stream. This was the heaviest fish I had on. My 75 lb. fish took 40 minutes, and did exactly the same thing.

They all make for the 1st opening into the large still pool behind the large rock island, and if one is run, out to this one can generally expect a good fish.' (P. 69), (1928).

Upper Mali Hka:—(Read the type-written Appendix at the end of the (old, club diary; full of information.)

'Pickthall's pool. or "The" pool. Fishable whenever it is possible to get to it, but is at its *best in the autumn*. The easiest way to fish this pool is from the rocks at the head. Cast into the main current and let the spoon swing round into the Pool beware, however, of sunken snags under the bank . . .

'Langley's pool is just below the suspension bridge on the right bank. This has been fished assiduously by many fishermen without any success since Langley's departure . . . His secret went with him'. (Appendix, pp. 3 & 4).

'In afternoon, ... At once taken by a very heavy fish, which sailed away, taking out all but two or three coils of 200 yards of line. . . .'

(P. 65. c).

Lengths of time recorded from hooking to landing of fish:—

82 lber.	'about 15 minutes.'	(Langley).
86 lber.	'about 12 or 13 mins.'	,,
41½ lber.	'2 hours.'	,,
59 lber.	'1½ hours.'	,,
60 lber.	'more than 60 minutes.'	,,
50 lber.	'about ½ hour.'	,,

Note.—This almost confirms the weight Cock and Hen-fish run to a reasonable belief and example that the 41⅓, 59, 60 pounder were Cock fish.

30. *Notes on the Mali H'ka.*—From the point of view of accessibility for fishing, the river is divisible as follows:—

1. From the Confluence of the N'Mai to Tiang Zup, (about 27 miles) the river is within a short distance of the P.W.D. road, which is motorable in the open season, weather permitting.

2. From Tiang Zup to Nawng Hkai:—

Corresponds to about 150 miles of road and is mostly sufficiently far from the P.W.D. road to necessitate pitching a camp.

3. The vicinity of Fort Herts. (Putao):—

The confluence near the Inspection Bungalow at Nawng Hkai, 13 miles from Fort Hertz, is the best water, but other places have been fished with success in the neighbourhood.

Facilities etc. for fishing the most easily accessible stretch of river from Myitkyina: (viz. 1 above):

Transport:—From October to May motor cars and vans traverse the road. During the Rains, only bullock carts and pack animals can be utilised.

Accommodation:—Inspection Bungalows, furnished, with crockery and cooking utensils, exist at Weshi (33rd mile). Nsopzup (42nd mile) and Tiangzup (55th mile).

Boats, etc.:—Sometimes can be hired at the Kwitao Ferry, 2 miles downstream from Weshi. The only certain means of having a boat in this section is to hire in Myitkyina and send it on ahead. Kachins will make rafts locally but they are of little use.

Supplies:—Should be taken out from Myitkyina, as only a limited number of fowls and eggs can be obtained on the spot.

Good fishing water:—

From *Weshi* 'dak' bungalow:—

Downstream:—For 4 miles to the 'Confluence' is fairly fast running with few rocks, pools or bends. Good fish have been landed, (*a*) at Kwitao, (*b*) from the Triangle side, from the rapid above the Confluence. A boat is very useful here.

A large freshwater shark has been caught near the Weshi bungalow, Upstream :—The Hpungin confluence, where fish other than mahseer have been landed on the sandy spit on the downstream side of the Hpungin Hka, as well as *Barbus tor*. A boat is not essential.

From Nsopzup, downstream from 2 miles from the bungalow as far as the Hpungin zup, 4½ miles by road.

Upstream :—disappointing for 2 miles, after which there is good water up to Njip zup, 7 miles by road.

There is a deep pool at the Njip confluence, from the top of which is a rapid, good fish have been taken.

Tiangzup :—Upstream :—The river leaves the road here and it is not easy to get more than a mile or so upstream.

From a mile upstream down to the head of the rapid half a mile downstream, including the Tiang zup, is good. This confluence has given up numbers of small fish, and several mahseer over 40 lbs. have been grassed just above the rapid.

Two miles downstream towards Njip zup (6 miles from Tiang zup), many fish have been hooked from the Triangle side.

Between Tiang Zup and Nawng Hkai :—

The Mali lies one or more days' march from the P.W.D. road. Few people have had opportunities of trying this stretch, which must include good places for angling. A tent and pawlins a necessity.

The best sport in the Putao area has been obtained from *Nawng Hkai* Bungalow.

MALI HKA

Actual Distances from Polymetrical Tables (1930)

Myitkyina	to	Mankrin	5	miles	*	
,,	,,	Watugyi	19	,,	*	
,,	,,	Confluence	28	,,		
Mule Road :—						
Confluence	to	Weshi	3½	,,		
Weshi	,,	N'sop zup	7	,,	*	
N'sop.	,,	Njip zup	6	,,		
Njip zup	,,	Tiang zup	5	,,	*	
Tiang zup	,,	Daru zup	10	,,	*	
Daru zup	,,	Waship zup	9½	,,		
Cast Road :—						
Myitkyina	to	Alam	12·5	,,		Total distance from Myitkyina :—
,,	,,	Chinghran Hka	21	,,	*	
,,	,,	Weshi	33·1	,,		
Weshi	,,	N'sop zup	8·7	,,	*	41·9 miles.
N'sop.	,,	Tiang zup	13·1	,,	*	55· ,,
Tiang zup	,,	Supkaga	9·0	,,		
Supkaga	,,	Kadrangyang	11·5	,,		
Kadrangyang	,,	Kawapang	9·0	,,		
Kawapang	,,	Tingpai	10·3	,,		
Tingpai	,,	Maitkon Hka	12·0	,,		
Maitkon Hka	,,	Wasat Hka	14·8	,,		122·6 ,,
Wasat Hka	,,	Machega	6·0			(to Sumprabux) 7·2 ,,
Mule Road :—						
Wasat Hka	to	Hpungin Hka	16·6	,,	*	138·2 ,,
Hpungin Hka	,,	Hpunchan Hka	10·9	,,	*	149·1 ,,
Hpunchan Hka	,,	Tutuga	11·1	,,		
Tutuga	,,	La-awn-ga	7·0	,,		
La-awn-ga	,,	Masum zup	13·8	,,		
Masum zup	,,	Hkamho	13·0	,,	*	(Namlang, etc.)
Hkamho	,,	Nawang Hkai	12·5	,,	*	(Namlang) 205·5 ,,
Nawng Kai	,,	Fort Hertz	13·0	,,		(Putao) 219·5 ,,

31. *The N' Mai Hka.—*

Accessibility :—From November till May, (weather permitting) by motor car and light lorry from *Waingmaw* via. Nausaung (11 miles) to Seniku (32 miles). The Namyin-Namlao Hkas at Wausaung are not worth fishing.

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* The better fishing spots marked.

From *Seniku* (good Inspection Bungalow), the confluences of Namli and Tumpang streams can be reached on foot within an hour, and the Tumpang confluence with the N Mai is then best arrived at by bamboo raft. All necessary information can be obtained from the Fishing Diary (1900-31), kept in the Dak Bungalow.

Beyond Seniku, Pack Transport or coolies must be resorted to. Only a very few of the latter are available near Seniku.

If the Tumpang area proves disappointing, move on to:—

Shingaw, not a bad spot.

Then on to *Tamu Zup*, the best angling place on the left bank of the N. Mai.

Give Tanga Hka a miss; poor for fish; a paradise for biting insects.

Chipwi Zup, 49 miles from Seniku, is very variable; the Maru's poison the water above the bridge on and off in the spring and autumn, thus making spinning at the Zup a waste of time.

General:—Virtually no supplies available anywhere. Bring up everything from Myitkyina. The occasional chicken and a few eggs are all that can be expected.

Include a rifle, tiger are quite plentiful and have taken quite a lot of mules etc., within shouting distance of Tenga, Tamu and Chipwi 1. B.S.

From February to November, a sandfly net and plenty of 'Flit' are essential; (From November to February the fishing is a wash-out, anyway, at Chipwi and upstream from there).

The N'Mai is less reliable than the Mali for Mahseer; a very rough general guide as to seasons is:—

Spring:—Seniku; end of February till the first big rise of the N'Mai, (which may be in March).

Tamu confluence; second week of March till beginning of May.

Autumn:—N'Mai and Tributaries:—Odd periods of a couple of days or so between the second week of September and the first few days of November.

After heavy rain, the Tamu Hka be expected to clear sufficiently for spinning within 36 hours; the Chipwi Hka does not clear for 3 or 4 days after a downpour.

If leave is short, previous application to the A/S. Sadon, for a raft to be made ready near Seniku (and at Shingaw) and for cooies, if required, is (or advisable).

Where to Fish in the N'Mai Hka.

(with rough sketches).

(Maps of the Mali Hka are to be found in the Myitkyina Club Fishing Book).

(1) From a Raft, drifting down the { *Tumpang* Hka. / *Namli* Hka. } to the Tumpang Zup. In the N'Mai a mile below the Tumpang Zup.

(2) Shingaw Hka and Zup. and small fish; vide sketch.

(3) *Tamu Hka* and Zup. Good for both large and small fish; vide sketch.

(4) 37th mile (from Seniku). 3 miles from Tamu I.B.

(5) Laima Zup. From Chipwi I.B. (5 miles by P.W.D. route, 3½ miles by short cut.

(6) Chipwi Hka and Zup. Vide sketch.

(7) Any other small zup.

(Reference maps 92 G/14., and 92 K/1.)

32. *Notes by P. W. Finch on the Fishing in Myitkyina*:—

'1931, At the Mali Hka and the Confluence, and in the N'Mai Hka was a bad year, and 1932 so far giving no sign of being a better one. There was one 60 lbs. fish caught in the N'Mai Hka in 1931, and one of 40 lbs., each in the same river and at the Confluence.

In 1932, W. caught fish of 38½ and 40½ lbs. in the Mali Hka, and J. was lucky enough to get two of 12 and 14 lbs. at Alam Village.

The Governor's party recently working really hard for 3 days, managed to get a 9-pounder.

R. T. who did very well before here, has just come along for a month's fishing and it will be interesting to see what he gets. I will make a point of letting you know when he comes back.

There is a very good camp at the Confluence now. Run by the Fishing Association, I am enclosing a copy of the new rules for your information.'

Also the Myitkyina Association Club Rules.

No note received.

33. *Myitkyina Fishing Association.*

It was decided at a meeting at the Myitkyina Club to form a Myitkyina Fishing Association. Every year many keen fishermen visit Myitkyina for the mahseer fishing in the Mali and N'Mai rivers and particularly at their Confluence 30 miles from Myitkyina.

A very comfortable and picturesque camp has recently been built at the Confluence and it has been decided to maintain this as a permanent fishing camp if sufficient funds are forthcoming.

There must be many keen fishermen in Burma who have been deterred from coming to Myitkyina to fish owing to the difficulty of obtaining information as to the places to fish and the difficulties of transport and bandobast.

With the advent of motor cars and lorries at Myitkyina the fishing is within easy reach. At the meeting Lt.-Col. A. Lethbridge, I.A. was voted to the Chair.

His Excellency Sir Charles Innes, K.C.S.I., C.I.E., I.C.S., Governor of Burma, has very kindly consented to become Patron of the Association.

After discussing the question of ways and means it was decided :—

1. That the Association should be run in connection with the Myitkyina Club.
2. That the Annual Subscription should be Rs. 10 for all members of the Association.
3. That the camp at the Confluence should be maintained and a small fee should be charged to members making use of it.
4. That the Honorary Secretary, Myitkyina Club, should be *ipso* (this is not the case at Keduent) *facto* Honorary Secretary of the Fishing Association and would supply members with all information and arrange for hire of boats, etc.
5. If sufficient support is obtained it will be possible to extend the activities of the Association so that members wishing to fish localities further afield will then be enabled to do so with as little inconvenience as possible. The present proposals cover the Irrawady and Mali Kha from Myitkyina to the 55th mile on the Putao Road.
6. Donations to give a start to the Association will be of great assistance.

Myitkyina, (*Sd.*) *Honorary Secretary,*
April 5, 1930. Myitkyina Club.

34. *T. P. Dewar's Notes.—*

Putao and Myitkyina.

T. P. Dewar, Esq., writes on the 'Best Time to Fish in the 14/4/28 Putao District'. Also on the Confluence.

12/4/32. Notes on the Chindwin District.

'*Best Time to Fish in the Putao District*'.

Your query as to which is the best time to fish in the Putao District April and May and again September and October. The Fishing during these months is absolutely dependent on the climate conditions. One can only be absolutely certain of clear water in November and December, January and early February. During these months one catches fish but has to work a good deal. Personally I prefer fishing in the winter to any other time of the year as there are no bugs and it is ever so much pleasanter.

'I shall be interested to know the result of your fishing. I am inclined to think, with the dry weather we have been having, that the snows will have melted and that you will find the confluence too discoloured. Don't forget to sink your spoon deep and get down to the big ones. You ought to do better in the bru, though I don't think you will get any thing over 30 lbs. in that stream. Your small rod ought to come in very useful. If you have time try the Mogawy R. from Wakawng. There are some lovely pools, and I have seen some very big fish up to 50 lbs. It has been a very good year in the Hukawng, but I was away in the Naga Hills for the best time. However I had a few afternoons in the Tarwg, my biggest landed being 40 lbs. I lost several other big fish, Hardy's special mahseer hooks snapping in the first big rush. Have been using the fly and have had good times. Here too I have had several weeks with big fish up to 10 lbs. I have just come back from a village where I lost five, however I landed fifteen, biggest 2½ lbs., two others 1½ lbs. each. Its great fun using light tackle and a fish weighing 5 lbs. feels like a monster and makes a small reel sing. I wish I had a 16-ft. salmon rod with a 4½ reel, I am sure I could have accounted for many a 15-20 lb. fish with fly this season.'

12-4-32. *Notes on the Chindwin District.* 'You will see that I am in the Chindwin area and I have much to say about this river, one of the very worst for fishing. The feeders are just as bad. I have just returned from a trip up the Uyu which rises from the Jade mines. Myitkyina District. A splendid stream for mahseer in these higher reaches but where it enters this District hopeless. I used a fly exclusively but took nothing beyond a one-pounder, and even this was not a mahseer. I only caught two tiny mahseer in the Uyu and was told by the local people that they do not exist. I believe it to a limit, so few it may well be said that in these lower clay bottom reaches they are non-existent. I have really never made any lengthy notes except it be the killing of a 37-pounder mahseer and an 85-pound turtle on a victor rod (7 oz.); and a remarkable experience which befell a companion fishing with me in the Mole R. Bhamo District. He hooked a one-pound mahseer on a salmon fly and out of the depths suddenly arose several long and hungry shadows the largest of which seized and swallowed that one-pounder the reel hummed for a space. My companion was so taken aback that he shouted out for instructions but these were unnecessary so hung on tight and after a while the fish came out again and the big feller got off. Not quite Jonah and the whale as if I recollect weight Jonah had much to say after his experience whereas the one-pounder looked as if he had had an experience with a threshing machine. Were these and other similar experience in your book I am afraid your reading public would fling the epitaph "Liar" after you. I am getting quite garrulous but then this is only possible while writing to you; were you before me now I expect I should be considered a very good listener. On this last trip I tried for bison but was unfortunate to hurt my leg before getting to the ground with the result that I lost one fine bull and could not get up to another and had to leave a herd of 30 odd alone. In that area I heard of one of those freaks of nature which occur in a decade. An albino bison the lord of a large herd. He has been frequently seen. I did not have the pleasure of seeing him, but should I be here next December I shall see what I can do. In the meantime I have reported the matter to the powers that be.'

THE BIRDS OF MYSORE.

BY

SÁLIM ALI.

With notes by Hugh Whistler.

PART V.

(*With one plate*).

(*Continued from Vol.* xliv, *No.* 1, *p.* 26).

Pterocles indicus (Gmelin). The Painted Sandgrouse.

Specimen collected: 561 ♂ 8-1-40 Marikānivē (2,500′).

[Measurements: 1 ♂ Bill 17.5, Wing 165.5, Tail 72 mm.—H. W.]

Status, Uncommon. Small numbers—pairs or small parties—were seen in sparsely scrubbed, stony country (deciduous biotope) in the environs of Vanivilās Sāgar Reservoir.

The testes of the specimen measured 8×5 mm.

Pterocles exustus ellioti (Bogdanow). The Common Indian Sandgrouse.

Specimen collected: 555 ♂ 7-1-40 Marikānivē (2,500′).

[Measurements: 1 ♂ Bill 16, Wing 182.5, Tail 129.5 mm.—H. W.]

Resident. Uncommon. Small flocks in the open, stony semi-desert in this locality. Drinking at accustomed spots at 9 a.m.

The testes of the specimen measured 7×5 mm. Major Phythian-Adams has taken eggs in the Mysore District on 9-4-37 and 17-3-38.

Pavo cristatus Linn. The Peafowl.

No specimens.

Noted: Bandipūr, Manchgowdanhalli, Balmoorie island (in Cauvery R., near Krishnārājsāgar), Nāmadachilumē, Marikānivē.

Resident. Not uncommon in certain localities, but on the whole rather scarce. Confined to deciduous biotope; occasionally met with in the dry-inter belt. Affects secondary forest with bamboo, in the neighbourhood of streams and rivers.

On 19 November (Bandipūr) a hen accompanied by 4 (or 5?) chicks about the size of a partridge was observed. Another hen (Marikānivē, 6 January) had 5 (or 6?) chicks with her, of the size of ¾ grown country pullets. When come upon suddenly far from cover in open grassland hardly tall or thick enough to shield her from view, the mother crouched along swiftly with lowered head and outstretched neck, taking advantage of every little unevenness of the ground, and leading her brood vanished from sight in a most amazing manner.

Gallus sonneratii Temminck. The Grey Jungle Fowl.

Specimens collected: 118 ♂ 20-11-39 Bandipūr (3,300′); 238 ♀ pull. 2-12-39 Manchgowdanhalli (2,500′); 735 ♂ 24-1-40 Bābābūdan Hills (4,500′—Kemmangūndi); 837 ♂ 5-2-40, 842 ♂ 7-2-40, 847 ♂ 8-2-40 Āgūmbē (2,500′). *Biligirirangan Hills*: 2 ♀ 6-11-39, 10 ♀ 7-11-39 (4,000′—Edbūthi); ♂ 19-12-32, M69 (H) ♀ 25-4-34 (5,000′—Honnametti).

Elsewhere noted: Antarsāntē, Devarbetta Hill, Nāmadachilumē, Balmoorie island (Cauvery R., near Krishnārājsāgar).

[Measurements :

	Bill	Wing	Tail
2 ♂♂ ad.	32-36	235-240	316-350 mm.
4 ♂♂ 1st winter	33-36	143-227	143-201 mm.
3 ♀♀ ad.	29.5-32	189-190	118-123 mm.
1 ♀ juv.	——	144	86 mm.

No. 238 ♀ juv. is in the first feather plumage which I do not find described anywhere. It resembles the adult female fairly closely—so that a separate description is not required—but the shaft streakings of the upper plumage and the lanceolate markings of the lower plumage are as a whole much less distinctly defined. The black stippling on the wings and tail also tends to coalesce into barring on the edges of the tertiaries and tail feathers.

Nos. 735, 837 and 842 and the Biligirirangan bird of 29 December are in what I call first winter plumage as described by Mr. Stuart Baker (*Game Birds*, iii, 154). They differ *inter se* however in a manner that suggests that the moult to adult plumage is gradual and irregular.—H. W.]

Resident. Common. I should place this jungle fowl as primarily of the intermediate zone. But it extends freely into the adjoining biotopes at either extreme, practically throughout the evergreen at one end, and up to the limit of light secondary and scrub-and-bush facies at the other.

Chicks in all stages, from slightly bigger than a quail to those in first winter plumage were met with during the period November to March. An adult cock (No. 118, 20 November) had testes enlarged to 12×6 mm. In another (847, 8 February) they measured 16×7 mm.

A Kūrūba game tracker, with intimate and fairly accurate knowledge of the local animals, asserted that the Grey Jungle Fowl is polygamous, each cock having 4 or 5 hens. According to him breeding continues throughout the year as in domestic fowls, the eggs being laid at different times as each hen becomes physiologically mature. From my own observations I am inclined to agree with this view and it is probably correct in the main, but confirmation is desirable.

Adult cocks frequently utter a loud bellicose challenging *Klick...kluck-kluck* repeated almost continuously often for over half an hour at a time, and more or less from the same spot. I have not been able to ascertain what this signifies.

The crop of a specimen was crammed with *Lantana* berries, some small tubers, and 41 fly larvae. (*Muscidae*) about 10 mm. long each.

Galloperdix spadicea spadicea (Gmelin). The Red Spur-Fowl.

Specimens collected : 196 ♀ juv. 29-11-39, 247 ♂ 3-12-39 Antarsāntē (2,500′); 693 ♂ 20-1-40 Bābābūdan Hills (2,500′—Jāgar Valley); 744 ♀, 745 ♀ 27-1-40, 794 ♂, 795 ♀ 31-1-40 Settihālli (2,500′); *Biligirirangans* : M38(G) ♂ 16-7-34 [3,000′—Ūdahatti Eastern (deciduous) base].

Elsewhere noted : Bandipūr, Manchgowdanhālli, Karāpūr, Devarbetta Hill, Saklēshpūr, Bhadrāvati.

[Measurements :

	Bill	Wing	Tail
4 ♂♂	22-24.5	156-161	120-130 mm.
3 ♀♀	21.5	145-151.5	109-121 mm.
1 ♀ juv.	——	128.5	102 mm.—H. W.]

Resident. Common. Confined to deciduous biotope; extending into the dry-inter belt. Typical habitat : Stony, broken hummocky country with ravines etc. covered with scrub, bamboo clumps, sprawling fallen bamboo thickets and brushwood with decaying logs here and there and plenty of mulch littering the ground.

Breeding was in progress throughout the period of the Survey (November to February). No. 196 (29 November) was a juvenile apparently about a month old. On 4 December a hen accompanied by a brood of 3 (or 4?) downy chicks, with wing quills sprouting and about 5 to 7 days old, was observed at Karāpūr. The ovaries of 744 and 745 (27 Jan.) were mature with the largest follicles measuring 3-4 mm. In the pair of 31 January the gonads were maturing: testes 8×4 mm.; ovary granular.

Coturnix coturnix coturnix (Linn.). The Common or Grey Quail.

Specimen collected: 574 ♀ 9-1-39 Jōgimaradi (3,400′—Chitaldrūg town environs).
Elsewhere not noted:

[Measurements: 1 ♀ Bill 14, Wing 115, Tail 36.5 mm.—H. W.]

Winter visitor. Uncommon. Shot on open, grass-covered hillside. One of the only pair seen in Mysore.

Coturnix coromandelica (Gmelin). The Black-breasted or Rain-Quail.

Specimens collected: 270 ♀ 5-12-39 Antarsāntē (2,500′); 357 ♀ 16-12-39 Sātnūr (2,500′); 550 ♂, 551 ♀, 552 ♂ 7-1-40 Marikānivē (2,500′).
Elsewhere noted: Chamarājanagar, Mysore City Environs.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	13-13.5	93-95.5	30-32 mm.
3 ♀♀	14	90-94	28-30 mm.—H. W.]

Resident and evidently in part also local migrant. Common. Restricted to deciduous biotope. Typical habitat: Flat open grassland, and grassy *bands* and edges of fields in cotton and other cultivation.

I believe that the population of resident Rain-Quails is augmented in the winter months (?) by an influx of visitors. Thus I make it that at Antarsāntē and Sātnūr the birds were largely (at any rate) resident. They had paired off, and breeding was in progress in December. No. 270 had a mature ovary with some follicles over 2 mm.; 357 held a hard-shelled oviduct egg. Males in these localities were calling on every hand early in the mornings and at evening dusk, and sporadically throughout moonlit nights. As against this the birds at Marikānivē, which I assume to be immigrants, kept in loose coveys, were silent and had undeveloped gonads.

The call of this quail is the well-known double note *Which-which* repeated every half second or so, 3 to 5 times running.

Perdicula asiatica asiatica (Latham). The Jungle Bush-Quail.

Specimens collected: 384 ♂ juv. 19-1-39 Māklidrūg (2,800′); [659-662 ♀ juv., ♀ juv., ♀ juv., ♂ juv. 17-1-40 Hebbalē (2,500′—Coorg)].
Elsewhere noted: Sātnūr.

[Measurements:

	Wing	Tail
2 ♂♂ juv.	82	37-41 mm.
3 ♀♀ juv.	70.5-80	33-37.5 mm.

Nos. 384 and 660 are in juvenile plumage and it is interesting to note that No. 384 is evidently starting to moult the secondaries before the outer primaries are fully grown. Nos. 659, 661 and 662 are moulting from the juvenile to the adult plumage—a complete moult—but all retain the 4 outer juvenile primaries on each wing.—H. W.]

Resident. Common. Restricted to deciduous biotope. Typical habitat: Flat, stony sparsely grass-covered scrub-and-bush country.

Perdicula argoondah sálimalii subsp. nov. The Laterite Rock Bush-Quail.

Specimens collected: 563 ♂ 8-1-40, 587-590 ♂, ♀ juv., ♂, ♂ 10-1-39 Marikānivē (2,500′).

[Measurements:

	Bill	Wing	Tail	Tarsus
2 ♂♂ ad.	13-14	80-85	37.5-41	23-26.5 mm.
2 ♂♂ imm.	14.5	83	38-41.5	22 mm.
1 ♀ juv.	—	76.5	39.5	— mm.

This is quite the most interesting series obtained by the Survey. In the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxviii, p. 686) I described a deep reddish race of the Jungle Bush-Quail from the South Konkan as *Perdicula asiatica vidali.* Now Mr. Sálim Ali has produced this series of bright brick-red specimens of the Rock Bush-Quail from Marikānivē in the Chitaldrūg District which are even brighter and redder than the red race of the other species. The discovery is made more interesting by the fact that with his usual care Mr. Sálim Ali preserved a sample of the bright brick-red soil on which the new race was found and with which it agrees perfectly.

The series consists of two adult males with the organs in breeding condition, two immature males which have largely assumed the adult plumage, and a juvenile female.

The adult males have the whole upper plumage wings and tail bright brick-red, agreeing with the colour of the forehead in the typical race; the forehead and a line above the buff superciliary streak are unmarked; the rest of the upper plumage is irregularly barred with black and dark brown and streaked and mottled with buff in the irregular manner, defying precise description, which is typical of this species. The lower plumage is similar to that of the typical race but is slightly warmer in tint, being washed with brick-red on the flanks, lower abdomen and undertail coverts.

The juvenile female has the upper parts very similar to the two adults, but the dark barring is largely absent and the buff shaft lines terminating in triangular buff terminal spots on the mantle, scapulars and tertiaries are more conspicuous; the whole lower plumage is warm buff tinged with brick-red, the throat and breast being irregularly barred with dark brown.

The type of this new race is No. 587 ♂ adult, 10 January 1940 Marikānivē, and it has been deposited in the British Museum.—H. W.]

Resident. Confined to deciduous biotope. Typical habitat: About the same as that of *asiatica*, but perhaps somewhat stonier ground with brick-red laterite soil.

These specimens were shot on laterite and moorum scraggy grass-covered stony terrain, and I noted in my diary at the time on the remarkably apatetic colouration of the birds.

The testes of 587 and 589 were enlarged to 7×4 and 9×6 respectively. They were, however, members of a covey containing several juveniles, so had presumably lately finished breeding.

Cryptoplectron erythrorhynchum erythrorhynchum (Sykes). The Painted Bush-Quail.

Specimens collected: *Biligirirangan Hills*: 61 ♀ 12-11-39 (5,000′—western slopes); M90(H) ♀ 17-5-34 (4,000′—Magoolibetta).
Elsewhere noted: Bābābūdan Hills (4,000′—Kemmangūndi).

[Measurements: 2 ♀♀ Bill 14-15, Wing 82-83, Tail 33-40 mm.—H. W.]

Resident. Fairly common. Confined to evergreen biotope, extending into the moist-inter belt. Affects the grass-covered hillsides and ridges, mixed with scrub, that separate the *sholas*. When flushed it utters a short whistle like the Grey Quail.

The specimen of 12 November was breeding. Ovary mature: largest follicle 6 mm.

Francolinus pictus (Jardine & Selby). The Painted Partridge.

Not met with by the Survey. Anderson (*Stray Feathers*, x, 428) records it from Chitaldrūg, Tūmkūr &c.

Francolinus pondicerianus pondicerianus (Gmelin). The Southern Grey Partridge.

Specimens collected: *Biligirirangan Hills*: M109-110(G) ♂♀ 2-8-34 (3,000′—Ūdahatti, E. (decid.) base).
Noted: Bandipūr, Maddūr (near Gūndlūpet), Begūr, Sātnur, Marikānivē, Pūnjūr.

[Measurements :

	Bill	Wing	Tail
1 ♂	25	143	77 mm.
1 ♀	24	142.5	78.5 mm.—H. W.]

Resident. Not common. Confined to deciduous biotope.
Typical habitat : Flat, dry scrub-and-bush country about cultivation.

Turnix suscitator taijoor (Sykes). The Common Bustard Quail.

Specimen collected : 596 ♀ 10-1-40 Marikānivē (2,500′).
Elsewhere noted : Devarbetta Hill, Hiriyūr.

Resident. Not common except at Hiriyūr. Confined to deciduous biotope. Affects short grass covered flat scrub-and-bush country. Partial to grass and thickets on the edge of cultivation. Seen singly or in pairs.

The specimen had a mature ovary with several follicles ca. 2 mm.

Turnix sylvatica dussumieri (Temm. & Laug). The Little Button Quail.

No specimens.

Apparently uncommon. Noted once (and the only!) in dry grass and scrub country (*T. taijoor* facies) at Marikānivē 6-1-40.

Porzana pusilla pusilla (Pallas). The Eastern Baillon's Crake.

Specimen collected : 488 ♀ 28-12-39 Dodballapūr (2,900′).
Not noted elsewhere.

Winter visitor. Evidently rare. Shot at a swamp (deciduous biotope).

Rallus eurizonoides amuroptera (Jerdon). The Banded Crake.

A specimen killed by Col. R. C. Morris on the Biligirirangan Hills (5,700 ft.) in August 1938 (*J.B.N.H.S.*, xl, p. 763). No other Mysore record.

Amaurornis phoenicurus phoenicurus (Pennant). The White-breasted Waterhen.

Specimens collected : 626 ♀ 14-1-40, 648 ♀ 16-1-40 Saklēshpūr (3,000′).
Elsewhere noted : Bandipūr, Palahally island (Cauvery R., near Seringapatām).

[Measurements : 2 ♀♀ Bill 36, Wing 159-164, Tail 67-71.5 mm.—H. W.]

Resident. Solos or pairs met with about swamps, amongst bushes and *Pandanus* thickets.

Both the specimens were very fat.

Gallinula chloropus indicus Blyth. The Indian Moorhen.

No specimens.
Noted : Bandipūr, Heggadedavankotē.
Resident (?). Small numbers observed on weed-choked tanks.

Porphyrio poliocephalus poliocephalus (Latham). The Indian Purple Moorhen.

No specimens.
Noted : Hiriyūr—Several at a reedy tank 9-1-40!

Resident. On 9 January a local villager brought me 2 eggs from amongst the reedbeds at the above tank which he said belonged to, and evidently were of, this species. The eggs were pinkish-grey, stippled with purplish-red.

Major Phythian-Adams took a clutch of 5 eggs at Bannūr (Mysore Dist.) on 22-11-36 and another c/3 at Nanjangūd 14-12-30. He notes that the Purple Moorhen is common on suitable reedy tanks in the Mysore District and he has often found nests with (average) c/5 in November and December.

Fulica atra atra Linn. The Coot.

No specimens.

Noted : Hiriyūr, Hassan, Kolār Gold Fields (Bētmangala tank). Small numbers were also observed on the tanks along the motor road from Saklēshpūr to Chikmagalūr.

Resident, but may partly also be a winter visitor. Major Phythian-Adams notes it as common on suitable reedy tanks in the Mysore District. He took a c/5 at Nanjangūd on 12-12-36 and 2 eggs from the same locality on 14-12-30.

Metopidius indicus (Lath.). The Bronze-winged Jaçana.

No specimens.
Noted: Heggadedavankotē, Karāpūr.
Resident (presumably). Single birds were seen on each occasion on vegetation covered tanks. According to Major Phythian-Adams it is fairly common in the Mysore District.

Hydrophasianus chirurgus (Scop.). The Pheasant-tailed Jaçana.

Not met with by the Survey. Major Phythian-Adams records it as fairly common in the Mysore District.

Rostratula benghalensis benghalensis (Linn). The Painted Snipe.

No specimen.
According to Major Phythian-Adams the Painted Snipe is fairly common about suitable reedy tanks at Gūndlūpet and Chamarājanagar in the Mysore District. He has also seen it at Bannūr near French Rocks, and near Seringapatām.
He has 2 eggs taken at Gūndlūpet 6-8-35.

Anthropoides virgo (Linn.). The Demoiselle Crane.

No specimens.
Winter visitor. Major Phythian-Adams states that flocks totalling several thousand visit the Kabani River above and below Nanjangūd annually between about 20 December and March. Latest date 5 March. They feed on the paddy stubbles mornings and evenings and pass the rest of the day [and night?] on sandbanks in the river. He has also seen them on the Yellandūr tanks and at the junction of the Cauvery and Kabani rivers at T. Narsipur.
Anderson (*S. F.*, x, 428) met the Demoiselle on the Tūngabhadra river at Harihār, south to Chitaldrūg and Sūlikeré lake.

Choriotes nigriceps (Vigors). The Great Indian Bustard.

No specimens.
Resident. Uncommon. Major Phythian-Adams has shot 3 in the Mysore District during the last 15 years, and seen several. One was shot by Mr. Van Ingen near Nelāmangalam (40 miles distant from Mysore City) early January 1940.
It is said to occur sparingly on the dry, open, sparse scrub-covered undulating plains in the Hiriyūr-Chitaldrūg locality. I have seen eminently suitable terrain around Huliyār also.

Sypheotides indica (Miller). The Lesser Florican or Likh.

No specimens.
Evidently very rare. Major P-A has only seen one example in the past 15 years some 30 miles north of Mysore City.

Burhinus œdicnemus indicus (Salvadori). The Indian Stone-Curlew.

Specimens collected: 153 ♂ 23-11-39, 167♂ 24-11-39 Bandipūr (3,300′).
Elsewhere noted: Antarsāntē, Marikānivē.

[Measurements: 2 ♂♂ Bill 40.5-45, Wing 205-220, Tail 105-106.5 mm. —H. W.]

Resident. Fairly common, but locally distributed. Confined to deciduous biotope. Affects open secondary bamboo and scrub jungle interspersed with clearings, in small parties of 3 or 4. Frequently met with on motor roads through this habitat at night.
Major P-A has a c/2 from the Mysore Dist. 28-6-36.

Esacus recurvirostris (Cuvier). The Great Stone Plover.

No specimens.
Noted: Palahally island (Cauvery R., near Seringapatām), Krishnārājsāgar ('Circuit House' island).

It is said by Major P-A to be common—in pairs—on rocky islets in certain sections of the Cauvery river. He took an egg at Yeddatore (Mysore Dist.) 11-4-37.

Cursorius coromandelicus (Gmelin). The Indian Courser.

Not met with by the Survey.

According to Major P-A locally distributed. He has observed it near Gūndlūpet and Mysore City where it frequents bare waste lands and stony plains with scattered scrub. He collected eggs c/2, c/2 in the latter locality on 9-6-36, and c/1 28-6-36.

Glareola lactea Temminck. The Small Indian Pratincole or Swallow-Plover.

Not met with by the Survey.

Very local, according to Major P-A. He took eggs (c/2) on an island in the Cauvery river below Talakād (Mysore Dist.) 10-4-37.

Larus sp. Gull.

Several gulls were observed on Krishnārājsagar Reservoir on 10-12-39, but they were too far away for identification.

Sterna aurantia Gray. The Indian River Tern.

No specimens.

Noted: Palahally island and about Seringapatām (Cauvery river), Krishnārājsāgar Vanivilās Sāgar (Marikānivē).

Major P-A notes: 'Common and widely distributed, frequenting tanks as well as rivers. A colony of 100 or more pairs was found in April nesting on an island in the Cauvery a short distance below the Krishnārājsāgar Dam, the clutches varying from 1 to 3 eggs.' He has several clutches in his collection taken below Kanambādi (Krishnārājsāgar) Dam, 7-4-36.

Sterna melanogaster Temm. The Black-bellied Tern.

Specimen collected: 355 ♂ 16-12-39 Sātnūr (2,500′).

Elsewhere not noted.

[Measurements: 1 ♂ Bill 42, Wing 230, Central tail 66.5, Outer tail 149 mm.—H. W.].

Major P-A considers this species scarcer than the River Tern. He observed several pairs on the Cauvery river below Talakād (Mysore Dist.) in April which were apparently breeding on an island in the river, but he failed to find their eggs.

Charadrius dubius jerdoni (Legge). Jerdon's Little Ring Plover.

Specimens collected: 260 ♀, 261 ♂ 4-12-39 Karāpūr (2,500′—Kabani River, Begūr).

[Measurements:

	Bill	Wing	Tail
1 ♂	14	108	55 mm.
1 ♀	16	108.5	58 mm.—H. W.]

Resident. Not common. Major P-A found it breeding in company with the Small Swallow-Plover on islands in the Cauvery river below Talakād in April 1937, and he has 2 eggs collected there on the 10th.

Charadrius dubius curonicus Gmelin. The Little Ring Plover.

Specimens collected: 150 o? 23-11-39 Bandipur (2,800′—Hangala); 467 ♀ 27-12-39, 484 ♂, 485 ♂ 28-12-39 Dodballapūr (2,900′).

Elsewhere noted (subspecies?): Vanivilās Sāgar (Marikānivē).

[Measurements:

	Bill	Wing	Tail
2 ♂♂ imm.	16.5-17.5	116-118	59.5-63.5 mm.
1 ♀ imm.	17	120.5	62.5 mm,

These 4 specimens are all immature, but their size leaves no doubt of their identity and the specimens afford a welcome confirmation of one of the winter quarters of this race.—H. W.]

Winter visitor. Small numbers observed on wet grassy tank margins and shingly river banks.

Pluvialis dominicus fulvus (Gmelin). The Eastern Golden Plover.

Not met with by the Survey.
Major P-A notes: 'Though this bird is a common cold weather visitor to Malabar, I have only once seen it in Mysore when I shot one from a party of 4 at Halladamadhahālli between Gūndlūpet and Begūr (on the Mysore road) on 5-11-1937'.

Lobivanellus indicus indicus (Bodd.). The Red-wattled Lapwing.

Specimens collected: 436 ♂ 24-12-39 Dodballapūr (2,900′); 559 ♂ 7-1-40 Marikānivē (2,500′).
Elsewhere noted: Palahally island (Cauvery R.), Seringapatām, Bandipūr, Maddūr, Bhimanbid (P-A.).

[Measurements: 2 ♂♂ Bill 34.5-35, Wing 220-231, Tail 118-123.5 mm. —H. W.]

Resident. Chiefly in deciduous biotope, but sparingly also in the intermediate zone up to the fringe of evergreen. Small numbers seen in appropriate habitats i.e., on river banks and margins of tanks. Also by pools and rain puddles in forest clearings or open glades. Usually pairs.

Lobipluvia malabarica (Bodd.). The Yellow-wattled Lapwing.

Specimens collected: 267 ♂ 5-12-39 Antarsāntē (2,500′); 372 ♂, 373 ♀ 17-12-39. Sātnūr (2,500′). *Biligirirangan Hills*: M58(G) ♂ 19-7-34, M101-102 (G) ♂ ♀ 28-7-34 (3,000′—Ūdahatti, Eastern (deciduous) base).
Elsewhere noted: Marikānivē, Gūndlūpet, Mysore City environs.

[Measurements:

	Bill	Wing	Tail
4 ♂♂	25.5-29	193-197	79-82.5 mm.
2 ♀♀	29	189-196	73.5-79 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Small loose parties affect dry, stony, open sparsely scrubbed country and fallow land about cultivation, unlike *Lobivanellus* often far from water.
Major P-A has taken a number of clutches of 2 or 3 eggs each near Gūndlūpet and in the environs of Mysore City on 14-6-35, 4-7-35 and other dates in June and July. Of these one c/2 (Mysore City environs, 9-6-36) was of the erythristic type. One of his Gūndlūpet clutches is of a colouration intermediate between the normal and the erythristic. (See *J.B.N.H.S.*, xli, 899).
No. 267 was very fat.

Himantopus himantopus himantopus (Linn.). The Black-winged Stilt.

No specimens.
Noted: Hangala tank (near Bandipūr), Hiriyūr, Hadinādu (near Nanjangūd).
Winter visitor. Fairly common at tanks, in flocks of up to 20 or so. According to Major Phythian-Adams it is one of the last migrants to leave Mysore, his latest date being 11 April (1931).

Tringa ochropus Linn. The Green Sandpiper.

Specimen collected: *Biligirirangan Hills*: M47(G) ♀ 25-9-34 (2,000′—Satyamangala).
Elsewhere noted: Jōgimaradi, Kolār Gold Fields, Hangala.
Winter visitor in small numbers. Usually seen singly at tanks, pools and puddles.

Tringa stagnatilis (Bechst.). The Marsh Sandpiper.

No specimens.

Noted: Heggadedavankotē, Begūr (Kabani R.), Kolār Gold Fields (Bētmangala tank). Also at Kalālē tank near Nanjangūd (P-A.).

Winter visitor. Fairly common. Seen in flocks, occasionally of up to 30 or so.

Actitis hypoleucos (Linn.) The Common Sandpiper.

No specimens.

Noted: Hangala tank (near Bandipūr), Heggadedavankotē, Krishnārājsāgar Reservoir.

Winter visitor: fairly common but not abundant. Usually met with singly. One was seen by Major P-A at Gūndlūpet as late as 27 July (1938). I have pointed out elsewhere that occasional individuals stay behind in their Indian winter quarters all through the year.

Tringa glareola Linn. The Wood Sandpiper.

Specimens collected: 149 ♂ 23-11-39 Bandipūr (2,800′—Hangala); 226-227 ♀♀ 1-12-39 Antarsāntē (Kabani R. near Begūr); 450-451 ♂♀ 26-12-39 Doddballapūr (2,900′); 575-578 ♂♀♂♂ 9-1-40 Hiriyūr (2,500′).

Elsewhere noted: Heggadedavankotē, Kolār Gold Fields (Bētmangala tank).

[Measurements:

	Bill	Wing	Tail
5 ♂♂	30-35	122-126	47-52 mm.
4 ♀♀	32-35.5	121.5-127	49-52.5 mm.—H. W.]

Winter visitor. The commonest sandpiper in Mysore State. Flocks of up to 20 or so seen at tanks and on swampy ground in open country such as inundated ploughed fields for paddy cultivation.

Tringa totanus subsp. The Redshank.

Not met with by the Survey.

Major Phythian-Adams shot 7 from a flock at Kalālē tank (near Nanjangūd) on 3-1-30 and thinks that it is perhaps a commoner winter visitor than this one record indicates.

Glottis nebularia (Gunnerus). The Greenshank.

No specimens.

Winter visitor. Rare. Noted only once—a solo at a tank, Sātnūr 16-12-39. According to P-A. 'Occasionally seen'.

Erolia minuta minuta (Leisler). The Little Stint.

Specimens collected: 579-581 ♂♀♂ 9-1-40 Hiriyūr (2,500′).

Elsewhere not noted.

Winter visitor. The specimens were shot from a flock of about 15 at a tank.

Scolopax rusticola Linn. The Woodcock.

No specimens.

Winter visitor. Rare. Col. R. C. Morris informs me that he has seen only 3 examples in the Biligirirangan Hills during the past 27 years, the last in 1938. It is evident that the majority of these birds pass over Mysore to their winter quarters in the Nilgiris without stopping.

Capella nemoricola (Hodgson). The Wood Snipe.

Not met with by the Survey.

Lt.-Col. J. M. Anderson (*S.F.*, x, 428) says he 'shot 2 in the jungles of Mysore west of Shimoga and heard of 2 others that were shot in the Manjerabad (Manzeerabad = Saklēshpūr) district'. This was in about the year 1883. Since then one more has been recorded shot near Bangalore on 14-12-1911 (*J.B.N.H.S.*, xxi, p. 677).

Capella gallinago gallinago (Linn.). The Common or Fantail Snipe.

No specimens.

Winter visitor. According to Major Phythian-Adams the Fantail generally arrives in the Mysore District in October and is very locally distributed. This species formed about 28% of his total bag of snipe made during the past 15 years, the first place being taken by Pintail (70%) and the third by Jack Snipe about (2%). For details of his seasonal bags see his informative article 'Small Game Shooting in Mysore' (*J.B.N.H.S.*, xli, 594).

Capella media (Lath.). The Great Snipe.

A specimen—one of the 3 hitherto recorded within Indian limits—was shot by Capt. A. Boxwell near Bangalore on 28-10-1910. It was put up 'from a piece of loose mud on the edge of a stream which divided some sugar cane from a rice field'. The bird weighed 7 oz. (*J.B.N.H.S.*, xx, 1155).

Capella stenura (Bonaparte). The Pintail Snipe.

Specimens collected: 201 ♂ 29-11-39 Heggadedavankotē (2,500′); 602 ♂ 11-1-40 Hiriyūr (2,500′).

[Measurements: 2 ♂♂ Bill 63-66, Wing 131.5-137, Tail 47-48 mm.—H. W.]

Winter visitor. According to Major Phythian-Adams this species is considerably more numerous in Mysore than the Fantail (see percentage of bags above). It arrives in September and most birds have left by 15 April, some staying on till early May. It is heavier in weight than the Fantail, averaging over 4 oz. against the latter's 3¼ oz.

At Nāmadachilumē (Tūmkūr Dist.) several solos were flushed amongst very dense tangles of *Lantana* on dry moorum soil, away from water. The birds after, zig-zagging overhead for some distance kept dropping into the *Lantana* thickets again and again.

A pair of Pintails was shot in a swampy forest glade in the Biligirirangan Hills at about 4,000 ft. on 1-1-1933.

Capella megala (Swinhoe). Swinhoe's Snipe.

Major Phythian-Adams shot 3 examples in the Mysore District during the season 1938-39—the only 3 in the past 14 years, so evidently very rare and erratic, but no doubt often passed over in bags as Pintail.

Limnocryptes minima (Brunnich). The Jack Snipe.

Not met with by the Survey.

Winter visitor. 'Distinctly uncommon, but their numbers vary from year to year without any obvious reason' (P-A).

Interesting notes on the arrival dates of snipe in Mysore and on the comparative frequency of Fantail, Pintail and Jack Snipe near Bangalore appear in Vols. xxxi (p. 1033) and xxxv (p. 900) of this journal.

Pelecanus sp. The — Pelican.

Major Phythian-Adams saw 6 or 7 of these birds at Māndya in February 1940 and says he generally sees a few each year.

Phalacrocorax carbo [**sinensis** (Shaw & Nodder)]. The Indian Large Cormorant.

No specimens.

Noted: Marikānivē. Small numbers on Vanivilās Sāgar Reservoir, 6-1-40.

Phalacrocorax fuscicollis Stephen. The Indian Shag.

No specimens.

Noted as fairly common, in association with flocks of the Little Cormorant, on islets and rocks in the Cauvery, between Seringapatām and Krishnarājsāgar Reservoir. Also on Vanivilās Sāgar at Marikānivē (unconfirmed).

Phalacrocorax niger (Vieillot). The Little Cormorant.

No specimens.

Noted as plentiful on islets and rocks in the Cauvery near Seringapatām and Krishnārājsāgar. Also on Vanivilās Sāgar.

Anhinga melanogaster Pennant. The Indian Darter or Snake-Bird.

No specimens.

Noted: Seringapatām, Palahally and other Cauvery islets; Vanivilās Sāgar; Bētmangala tank (K.G.F.). Small numbers.

Platalea leucorodia Linn. The Spoonbill.

Not met with by the Survey between November and March.

Evidently resident as Major Phythian-Adams writes 'Flocks up to 20 have been seen at Gūndlūpet in July-August, but I have not yet discovered where they breed'.

Threskiornis melanocephalus (Latham). The White Ibis.

No specimens.

Noted: Palahally island and another small islet in the Cauvery near Seringapatām, 27-11-39. Only 2 or 3. According to Major P-A. it is less common than the Black Ibis.

Possibly breeds here during the S.-W. Monsoon.

Pseudibis papillosus (Temm. & Laug.). The Black Ibis.

No specimens.

Noted: Hangala tank (near Bandipūr, 22-11-39)—a pair!

Major Phythian-Adams writes 'Frequently seen round Gūndlūpet—a flock of a dozen on 26-7-38—and evidently resident though I have not yet found any nests.'

Ciconia ciconia ciconia (Linn.). The White Stork.

Specimen collected: 603 ♂ 11-1-40 Hiriyūr (2,000').

Elsewhere not noted.

[Measurements: 1 ♂ Bill from feathers 202, Wing 603, Tail 234 mm.

The bill is bright red.—H. W.]

Winter visitor. Rare. The specimen was one of a pair. Another pair was observed on rocks in the river near Nanjangūd (January).

Dissoura episcopa episcopa (Bodd.). The White-necked Stork.

Not met with by the Survey.

Major P-A. has seen it sparingly at Gūndlūpet and Chamarājanagar in July-August but has not yet discovered where they nest.

Ibis leucocephalus (Pennant). The Painted Stork.

Not met with by the Survey.

Major Phythian-Adams's remarks above apply also to this species, but it is evidently seen in larger numbers.

Anastomus oscitans (Bodd.). The Open-billed Stork.

No specimens.

Noted: Palahally and neighbouring islands in Cauvery River near Seringapatām; at tanks between Chennapatna and Sātnūr; Hūliyār.

Resident. Not uncommon, in small numbers. Usually seen in scattered pairs and parties of 3 or 4.

On 8 December (39) a nest was observed on the top of a small tree on an islet in the Cauvery near Palahally Bird Sanctuary, containing 3 full-fledged young which fluttered out of the nest on a shot being fired nearby.

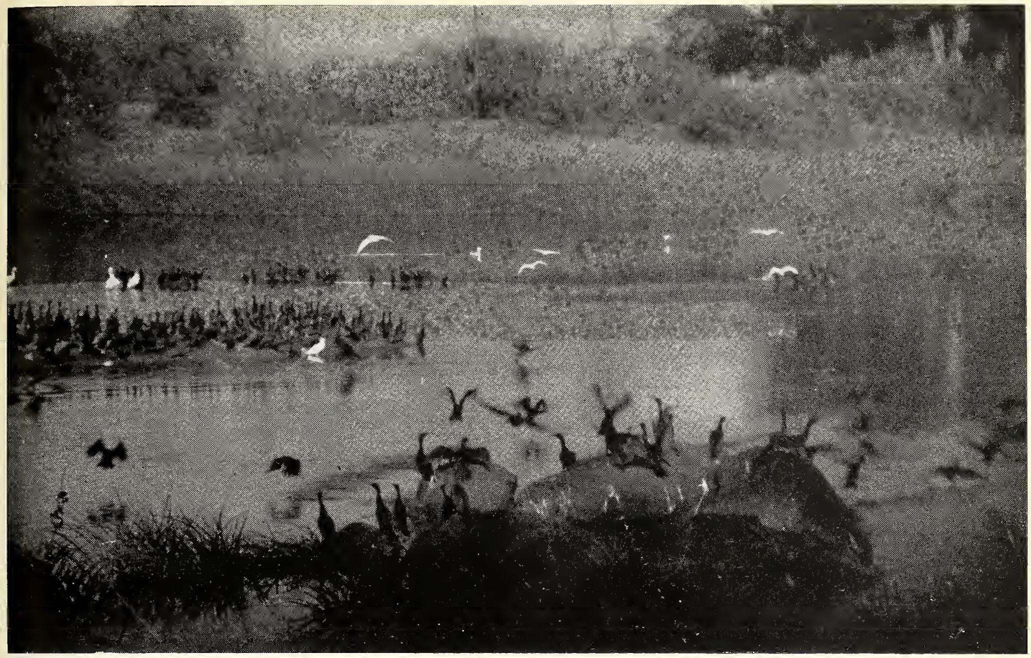

Photo by *Sir Charles Todhunter*

1. Little Cormorants (*Phalacrocorax niger*) and Small Egrets (*Egretta J. garzetta*) on rocks in the Cauvery near Palahally Island (Seringapatam), the newly created Bird Sanctuary.

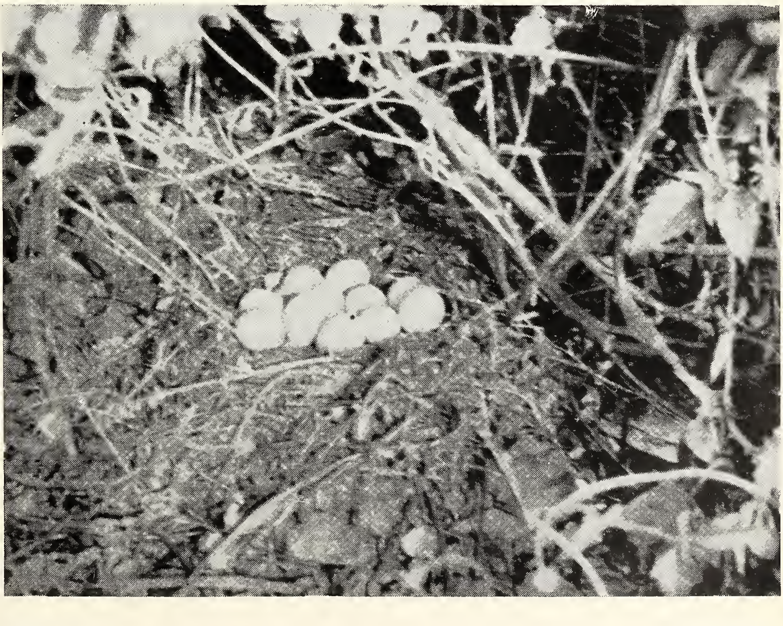

Photo by *Salim Ali*

2. Nest and eggs (*c*|11) of the Spot-billed Duck (*Anas poecilorhyncha*) on an islet in Vanivilas Sagar (Marikanive). 6-1-1940.

Ardea purpurea [manillensis Meyen]. The Eastern Purple Heron.

No specimens.

Noted: On small islets in the Cauvery near Seringapatām 27-11-39; Bētmangala tank (K.G.F.) 21-2-40.

Not common. Solos!

Ardea cinerea [rectirostris Gould]. The Eastern Grey Heron.

No specimens.

Noted: Begūr (Kabani River 1-12-39); Krishnarājsagar ('Circuit House' island 23-2-40).

Uncommon. Solos!

Egretta alba subsp. The Large Egret.

No specimens.

Noted: Hūliyār 12-1-40. 2 solos at tank.

Egretta intermedia intermedia (Wagler). The Indian Smaller Egret.

No specimens.

Noted: On islets in the Cauvery near Seringapatām; on rocks in Kabani river near Begūr; on shoals and islets in Vanivilās Sāgar; at Bētmangala tank (K.G.F.).

In small numbers.

Egretta garzetta garzetta (Linn.). The Little Egret.

No specimens.

Noted: in same localities as above.

Fairly common. Seen in parties and flocks.

Bubulcus ibis coromandus (Bodd.). The Cattle Egret.

No specimens.

Noted: Kolār Gold Fields. A small scattered flock by grazing cattle on grassy margin of Bētmangala tank.

Ardeola grayii (Sykes). The Indian Pond Heron or Paddy-Bird.

Specimen collected: 456 ♂ 26-12-39 Dodballapur (2,900′).

[Measurements: 1 ♂ Bill from feathers 61, Wing 214, Tail 74 mm.—H. W.]

Elsewhere noted: Seringapatām and Palahally (Cauvery River); Heggadedavankotē; Karāpūr.

Resident. Common. Single birds or loose scattered parties seen at rivers, tanks and puddles.

Major Phythian-Adams's collection has an egg (fresh) taken near Mysore City, 7-9-36.

Nycticorax nycticorax nycticorax (Linn.). The Night Heron.

Specimens collected: 289-291 ♀ ♂ ♀ Seringapatām (Palahally island).

[Measurements:

	Bill from feathers	Wing	Tail
1 ♂	74	291	104 mm.
2 ♀ ♀	72-72.5	277-281	100-101.5 mm.—H. W.]

A colony of 3 to 4 hundred birds among bushes and dense *Pandanus* brakes covering islets in the Cauvery between Seringapatām and Krishnārājsāgar Reservoir. The tops of the bushes and small trees here were covered with hundreds of old nests, some presumably of this species. The breeding must have finished months ago since the colony now contained no juvenile-plumaged birds.

All the 3 specimens were excessively fat.

Botaurus stellaris stellaris (Linn.). The Bittern.

A specimen was shot by Major Phythian-Adams at Hadinādu near Nanjangūd (Mysore Dist.) on 12-12-36 (*J.B.N.H.S.*, xxxix, 870). This is the only record for Mysore so far.

Sarkidiornis melanotus (Pennant). The Nukta or Comb-Duck.

Not met with by the Survey.

Major P-A. has seen only 2 (near Gūndlūpet) during his 16 years in Mysore and shot his first in S. India 50 miles W. of Bangalore on 14-1-43 (*J.B.N.H.S.*, xliv, 130). He thinks that Theobald's record of it from Kollegal must refer to the Yellandūr tanks in Mysore State which were favourite shooting grounds of Theobald's. One of a party of 4 was also obtained by Mr. R. F. Stoney near Gūndlūpet on 30-11-41 (*ibid*, xliii, 525). Evidently rare.

Nettapus coromandelianus (Gmelin). The Cotton Teal.

No specimens.

Noted: Bētmangala tank (K.G.F.). A scattered flock of about 15.

Major P-A describes it as common throughout the Mysore District in flocks of 5 to 500. He has frequently seen as many as 15 pairs in July, but thinks that while some certainly stay on throughout the year, the great majority must be migrants.

Anser indicus (Latham). The Bar-headed Goose.

No specimens.

Noted: Vanivilās Sāgar (Marikānivē) 6-1-40. Two or three flocks of about 20 each. Very wild.

Winter visitor. According to Major P-A. nowhere common but generally distributed in the Mysore District, the gaggles varying from half a dozen individuals to 150 (exceptional). A favourite locality is between Chamarājanagar and Gūndlūpet. He has also frequently seen them near Nanjangūd. In the past 14 years he has shot 28, the best day producing 8 birds. They feed in the paddy stubbles.

Dendrocygna javanica (Horsf.). The Lesser or Common Whistling Teal.

Specimen collected: 200 ♂ 29-11-39 Heggadedavankotē (2,500′).

Elsewhere noted: Bandipūr.

[Measurements: 1 ♂ Bill from feathers 39, Wing 189, Tail 50 mm.—H. W.]

Resident. Common. Found on weedy tanks and sometimes rivers. Small flocks of 6 to 10, but according to Major Phythian-Adams occasionally numbering over a hundred. He once counted 25 pairs on a tank near Gūndlūpet in June. A pair of adults with 7 ducklings were seen by him on a roadside tank near Hampāpūra on 21-12-32, and ducklings in another locality on 13-12-36. There is a c/9 in his collection taken from a nest among reeds on a Cauvery island above Seringapatām 15-8-38.

At Bandipūr on a weed covered tank, I observed an adult bird accompanied by 5 (or 6?) downy ducklings a few days old, 19 November. The ducklings swam on the far side of their parent, slightly to the rear all strung in a bunch extending beyond the tail. To the naked eye it looked exactly as if the duck was towing a bunch of floating weeds!

Dendrocygna fulva (Gmelin). The Large Whistling Teal.

Not met with by the Survey.

Major P-A has only once shot a single specimen during 14 seasons' shooting in Mysore, from a small flock on the Kabani river behind the Travellers' Bungalow at Nanjangūd.

Casarca ferruginea (Vroeg). The Ruddy Sheldrake.

Not met with by the Survey.

Winter visitor. 'Not common. The most seen were 20 on a sandbank in the Cauvery River' (P-A).

Anas pœcilorhyncha pœcilorhyncha Forster. The Spotbill or Grey Duck.

Specimens collected: 546-547 ♂♂ 6-1-40 Marikānivē (2,500′—Vanivilās Sāgar).

Elsewhere noted: Chamarājanagar, Hangala tank (near Bandipūr).

[Measurements: 2 ♂♂ Bill from feathers 52.5-59.5, Wings moult, Tail 97-99 mm.

One of these birds is quite flightless with all the primaries and secondaries in short quill; the other has dropped the outer primaries and would soon be in the same condition.—H. W.]

Resident, but according to Major Phythian-Adams its numbers are certainly increased by visitors during the cold weather when flocks numbering upwards of 100 are sometimes found on the larger tanks in Mysore District. He has found oviduct eggs on 15 October and 24 November, and ducklings in January (1931).

Out of a flock of 6 (from which the survey specimens were shot) only 1 bird could fly. All the rest were, like the specimens, in heavy moult and flightless. On the approach of our boat the birds made for the shore of a scrub-covered stony islet and shuffled along the ground over the loose stones with astonishing celerity, cunningly concealing themselves amongst the sparse bushes and every little unevenness of the surface. Curiously enough the testes of the specimens showed considerable development. They measured 18×7 and 17×7 mm., and breeding was in progress. A nest was found under a bush on the stony edge of this island about 3 ft. away from the water. It was a pad of grass with some feathers in the lining, and contained 11 greenish-white eggs. While I am unable to assert definitely that it belonged to one of these flightless moulting birds, the probability of such being the case is great. On the other hand it is possible that all the 6 flightless birds were, like the specimens, males, and that the brooding duck was as yet free from moult.

Anas strepera (Linn). The Gadwall.

Not recorded by the Survey.

Winter visitor. Rare. Major Phythian-Adams has got only one example in the Mysore District during 14 seasons' shooting.

Anas penelope (Linn). The Wigeon.

No specimens.

Noted: Kolār Gold Fields. A few on Bētmangala tank 23-2-40.

Winter visitor. In the Mysore District, Phythian-Adams finds it uncommon. Its numbers are said to vary greatly from year to year, and it is erratic in its occurrences.

Anas crecca crecca (Linn.). The Common Teal.

Specimens collected: 584 ♀ 9-1-40 Hiriyūr (2,500′).

Elsewhere noted: Hūliyār, Chamarājanagar, Heggadedavankotē, and on tanks in the Hassan, Kadūr and Kolār Districts.

[Measurements: 1 ♀ Bill from feathers 33, Wing 170.5, Tail 61 mm.—H. W.]

Winter visitor. According to Major Phythian-Adams 'Not common [in Mysore Dist.] and seldom found in flocks of over 20. More abundant some years than others.'

Anas querquedula (Linn.). The Garganey or Blue-winged Teal.

No specimens.

Noted: Hangala tank (near Bandipūr); Chamarājanagar, Hūliyār, and on tanks in Hassan and Kadūr Districts.

Winter visitor. According to Phythian-Adams 'the commonest duck in Mysore, outnumbering even the Pintail and Cotton Teal, the flocks varying from 25 to 200 or more'.

Dafila acuta (Linn.). The Pintail.

No specimens.

Noted: Bandipūr (Hangala tank), Hūliyār, Hiriyūr. Also on tanks in the Hassan and Kadūr Districts.

Winter visitor. Fairly common in small numbers on tanks. In the Mysore District Major P-A says 'Large flocks, numbering anything up to 400, visit all the bigger tanks during the cold weather. They first arrive in November . . .'

Spatula clypeata (Linn.). The Shoveller.

No specimens.

Noted: Hangala tank (near Bandipūr), Hiriyūr, Hūliyār and on other tanks in the Hassan and Kadūr Districts.

Winter visitor. 'A few birds are generally to be found on most tanks (in the Mysore Dist.) in the cold weather, and at times flocks of up to a dozen or more occur'. (P-A).

Aythya ferina ferina (Linn.). The Pochard or Dun-bird.

No specimens.

'An irregular winter visitor but by no means as rare as indicated in 'Birds of South India' (P-A). In January 1938 at a tank near Bannūr the same observer saw a flock estimated as from 3 to 4 hundred in number—the largest he has seen.

Aythya rufa rufa Linn. The White-eyed Pochard.

No specimens.

Noted: In small numbers on tanks at Hiriyūr, Hūliyār and elsewhere.

Curiously enough Phythian-Adams seems to have found it very rare in the Mysore District. His game record for the past 14 years shows only a single bird of this species shot.

Aythya fuligula fuligula (Linn.). The Tufted Pochard.

No specimens.

Noted: A few on Bētmangala tank (Kolār Gold Fields).

Winter visitor. 'Somewhat rare' (P.-A.).

Podiceps ruficollis capensi Salvadori. The Indian Little Grebe.

Specimens collected: 171 ♂, 172 pullus 25-11-39 Bandipūr (3,300′).

[Measurements: 1 ♂ ad. Bill 24.5, Wing 101, Tail 33, Tarsus 35.5 mm. —H. W.]

Resident. Present in small numbers on most tanks. No. 171 was shot off a nest which besides 172 (downy hatchling a few hours old) contained 4 hard-set eggs ready to hatch. The nest was a small cone of rubbish in shallow water amongst sparse floating weeds. When approached, the brooding bird got up, hurriedly covered the eggs with leaves etc. and dived away from its proximity.

Major Phythian-Adams has collected c/3, c/3, c/1 on 12-11-26 and c/3 on 11-9-27 near Maddūr (Gundlūpet).

THE END

ON THE BIRDS OF THE KAREN HILLS AND KARENNI FOUND OVER 3,000 FEET.

BY

H. C. SMITH, M.B.O.U., F. F. GARTHWAITE, AND
B. E. SMYTHIES,

Burma Forest Service,

assisted by

The late DR. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U., etc.

(*Continued from page 72 of this volume*).

PART III.

WOODPECKERS.

Remarkably few species of Woodpecker were seen in the area; the following are all more or less common species of the foothills (Pegu Yomas), but their elevation ranges appear to be more restricted than one might expect. We saw none of them.

1339. **Picus xanthopygaeus.** Little Scaly-bellied Woodpecker.

1341. **Picus viridanus.** Burmese Scaly-bellied Woodpecker.

1345. **Picus canus hessei.** Burmese Black-naped Green Woodpecker.

1352. **Picus erythropygius.** Red-rumped Green Woodpecker.

(*a*)1357. **Gecinulus grantia viridis.** Southern Pale-headed Woodpecker.

(*b*)1372. **Dryobates analis longipennis.** Siamese Pied Woodpecker.

1404. **Chrysocolaptes g. guttacristatus.** Tickell's Golden-backed Woodpecker.

(*c*)1409. **Hemicercus c. canente.** Heart-spotted Woodpecker.

1413. **Macropicus javensis.** Great Black Woodpecker.

Notes.—

(*a*) Karen Hills 2,500 feet (Wardlaw Ramsay).
(*b*) Karenni (Wardlaw Ramsay).
(*c*) Karen Hills (Wardlaw Ramsay).

Dr. Heinrich in his paper on the birds of Mt. Victoria comments on the remarkable decrease in the number of Woodpeckers with increase of height, and traces it to a corresponding decrease in the number of ants.

1348. **Picus chlorolophus chlorolophoides.** Burmese Small Yellow-naped Woodpecker.

Previous records.—Karenni 3,000 feet (Wardlaw Ramsay).
Specimens.—Nattaung 1♂, 1♀.
Noted.—Not seen at Thandaung. Not common.

1353. **Chrysophlegma f. flavinucha.** Large Yellow-naped Woodpecker.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not uncommon both on Nattaung and at Thandaung.

1369. **Dryobates macei atratus.** Stripe-breasted Pied Woodpecker.

Previous records.—Karen Hills 3,000-4,000′ (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♀, 1 o.
Noted.—This and the next are the common Woodpeckers of the area, frequently seen solitary or in pairs in all types of forest.

1379. **Dryobates nanus canicapillus.** Burmese Pigmy Woodpecker.

Previous records.—Karenni 4,000 feet (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♀.
Noted.—Usually seen in pairs, but a party of three was observed at Thandaung in April.

1383. **Blythipicus p. pyrrhotis.** Red-eared Bay Woodpecker.

Previous records.—Toungoo hills (Wardlaw Ramsay).
Specimens.—Thandaung 1 ♀.
Noted.—Fairly common and observed up to 7,000 feet. In addition to the harsh *churra-cha-churra-cha-churra* call it has a loud piercing cuckoo-like call of 7-8 notes dropping slightly in pitch at the end; it is a shy bird, usually seen in bamboo thickets or evergreen, keeping fairly low down and sometimes feeding on the ground. The large size and massive light yellow bill tinged greenish are diagnostic; the red neck patches of the male are conspicuous, and the female has the head noticeably lighter than the rest of the plumage.

1399. **Dinopium javanensis intermedia.** Burmese Golden-backed Three-toed Woodpecker.

Previous records.—Very abundant in Karenni (Oates).
Specimens.—None.
Noted.—A party of 3 birds was seen in pine forest at 4,000 feet on Nattaung.

1411. **Mulleripicus pulverulentus harterti.** Indian Great Slaty Woodpecker.

Previous records.—Abundant in Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

1417. **Vivia innominata malayorum.** Malay. Speckled Piculet.

Previous records.—Karen Hills 2,000 feet (Wardlaw Ramsay).
Specimens.—None.
Noted.—Common both on Nattaung and at Thandaung and partial to bamboo thickets.

1419-21. **Sasia ochracea** subsp. Rufous Piculet.

Previous records.—None?
Specimens.—Thandaung 1 ♂.
Noted.—Seen on Nattaung also, but it is less common than the Speckled Piculet.

1423. **Jynx torquilla** subsp. Wryneck.

Previous records.—Karenni, plains and hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

1426. **Megalaima v. virens.** Chinese Great Barbet.

Previous records.—Karen hills and Papun district.
Specimens.—Nattaung 1 ♀.
Noted.—Common at Thandaung also.

1436. **Cyanops asiatica asiatica.** Blue-throated Barbet.

Previous records.—Hills east of Toungoo, common (Wardlaw Ramsay).
Specimens.—None.
Noted.—Once on Nattaung at 3,000 feet on the Kemapyu stream, and fairly common at Thandaung in May; probably commoner lower down.

1441. **Cyanops duvauceli cyanotis.** Blue-eared Barbet.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—None seen by us.

1445. **Cyanops franklinii ramsayi.** Ramsay's Golden-throated Barbet.

Previous records.—Karenni, type locality (Wardlaw Ramsay).
Specimens.—Nattaung 1♂; Thandaung 1♂.
Noted.—This is one of the characteristic birds of the area and its loud shout of *look-'igh-up*, *look-'igh-up*, . . . , is heard throughout the forests. Other notes are (1) a single *tonk*, (2) a *tuck-tuck-tuck-kroooooooo* call, (3) a harsh shrill chatter, heard only in April and connected with sexual chases. It is not a shy bird.

1446. **Xantholaema haemacephala indica.** Coppersmith.

Previous records.—Chilla, Karen Hills (Fea); Karenni (Oates).
Specimens.—None.
Noted.—Common in Toungoo town, but not seen by us in the higher hills, where it must be very local and scarce.

1453. **Cuculus canorus bakeri.** Khasia Hills Cuckoo.

Previous records.—Abundant on the tableland of Karenni (Wardlaw Ramsay).
Specimens.—Thandaung 1 ♀ (Wing 200 mm. Identified by us provisionally as *C. c. telephonus.*)
Noted.—A male was heard calling once or twice on Nattaung, but it seems to be scarce. The specimen was obtained in the tea estate at Thandaung on 8-10-41.

1455. **Cuculus p. poliocephalus.** Small Cuckoo.

Previous records.—None nearer than Maymyo.
Specimens.—Thandaung 1 imm. (7 October 1941).
Noted.—We saw no others and did not hear the call at any time. The specimen was obtained by the path up to Thandaung-gyi.

1456. **Cuculus m. micropterus.** Indian Cuckoo.

Previous records.—None before 1939.
Specimens.—Nattaung 1♂; Thandaung 1♂ (10-10-41).
Noted.—Fairly common.

1457. **Hierococcyx sparveroides.** Large Hawk-Cuckoo.

Previous records.—Karenni 4,000 feet (Wardlaw Ramsay).
Specimens.—None.
Noted.—Common.

1460. **Hierococcyx fugax nisicolor.** Hodgson's Hawk-Cuckoo.

Previous records.—Once near Thaton (Davison).
Specimens.—Thandaung 1♂ imm. (20 March), 1 o (7 October 1941).
Noted.—One other was seen early in May, being mobbed by *Iole virescens* as it worked through the understorey in forest. It seems to be a very quiet bird for a Cuckoo; its note was not heard once, and for this reason it is no doubt largely overlooked.

1463. **Cacomantis merulinus querulus.** Burmese Plaintive Cuckoo.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—The cadence call of this bird is heard all along the Mawchi road in April, and it is probably the commonest Cuckoo in the area.

[1464-5. **Penthoceryx sonneratii** subsp. Banded Bay Cuckoo.

This should occur, but there are no records to date.]

1467. **Chalcites xanthorhynchus.** Violet Cuckoo.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

1468. **Chalcites m. maculatus.** Emerald Cuckoo.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None this year.
Noted.—Observed only on Nattaung. One party of about half-a-dozen birds was seen in a *ponzo*, flying from tree to tree and uttering a quick high-pitched rattle of 5-6 notes, descending slightly in pitch. Such activity is unusual in this bird, and the bright sunlight showed up well the beautiful plumage. One other bird was seen sitting sluggishly at the top of a dead tree by the roadside.

1470. **Surniculus lugubris** subsp. Drongo-Cuckoo.

Previous records.—Karen Hills (Salvadori); Karenni (Oates).
Specimens.—Thandaung 1 ♀, not examined by Dr. Ticehurst.
Noted.—We saw only the one bird, on a dry ridge in light forest along the Leiktho mule path; it seems to be scarce.

[1472. **Clamator jacobinus.** Pied Crested Cuckoo.

The *F.B.I.* states that this bird occurs in Karenni, on what authority is not known.]

1474. **Clamator coromandus.** Red-winged Crested Cuckoo.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♀.
Noted.—The only bird seen was obtained at 3,000 feet beside the Kemapyu stream.

1480. **Rhopodytes tristis** subsp. Large Green-billed Malkoha.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Seen occasionally in undergrowth and wet thickets both on Nattaung and at Thandaung.

1491. **Centropus sinensis intermedia.** Hume's Crow-Pheasant.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—A pair was heard calling daily at Thandaung in the tea estate during April and May and they may have been breeding there.

1495. **Centropus b. bengalensis.** Lesser Crow-Pheasant.

Previous records.—Karenni.
Specimens.—None.
Noted.—Seen once in the tea estate at Thandaung, early in May.

1501. **Psittacula krameri borealis.** Eastern Rose-ringed Parrakeet.

Previous records.—Karen Hills, rare (Wardlaw Ramsay).
Specimens.—None.
Noted.—The complete absence of all species of Parrakeet was very striking, and it is curious that these birds, with their strong powers of flight, seem to avoid the higher hills.

1503. **Psittacula cyanocephala rosea.** Eastern Blossom-headed Parrakeet.

Previous records.—Karen Hills and Karenni.
Specimens.—None.
Noted.—Not seen by us.

1505. **Psittacula himalayana finschii.** Burmese Slaty-headed Parrakeet.

Previous records.—Karen Hills (Wardlaw Ramsay); north of Papun (Davison).
Specimens.—None.
Noted.—Not seen by us.

1513. **Coryllis v. vernalis.** Indian Lorikeet.

Previous records.—Karen Hills (Salvadori).
Specimens.—None.
Noted.—Not seen by us.

1519. **Coracias benghalensis affinis.** Burmese Roller.

Previous records.—None?
Specimens.—None.
Noted.—One bird was seen on Nattaung in pine forest at 5,000 feet, 8 April.

1520. **Eurystomus o. orientalis.** Broad-billed Roller.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—One bird was seen on Nattaung close to where the Burmese Roller was seen, and on the same day.

1524. **Merops orientalis birmanus.** Burmese Green Bee-eater.

Previous records.—Yado (Salvadori).
Specimens.—None.
Noted.—A party was noted roosting in a tree near the Circuit House at Thandaung on 22 October.

1526. **Merops superciliosus phillippinus.** Blue-tailed Bee-eater.

Previous records.—Thandaung, nesting (Cook).
Specimens.—None.
Noted.—Two small parties were seen flying past pine forest at 5,500 feet on Nattaung. This bird rarely seems to hawk insects from a perch like the smaller Bee-eaters, and is typically seen flying steadily in a fixed direction; it is a great wanderer.

1528. **Merops l. leschenaulti.** Chestnut-headed Bee-eater.

Previous records.—None?
Specimens.—None.
Noted.—This bird is also a wanderer. Several were seen on the telegraph wire on the road to Thandaung on 15 October, whereas none was seen in September. They were still in Thandaung when I left on 12 May.

1529. **Alcemerops athertoni.** Blue-bearded Bee-eater.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—A pair was seen in bamboos along the Leiktho path on 15 October, and a bird was heard at 5,000 feet near the Kolo stream on Nattaung. In May it breeds in numbers all up the Thandaung road up to 4,000 feet. All Bee-eaters seem to be local migrants or wanderers, and little is known of their movements.

1532. **Ceryle lugubris guttulata.** Himalayan Pied Kingfisher.

Previous records.—Hills north of Papun and the higher portion of the Yunzalin (Davison).
Specimens.—None.
Noted.—Not seen by us.

1533. **Alcedo atthis bengalensis.** Common Indian Kingfisher.

Previous records.—Karenni.

Specimens.—None.
Noted.—One seen at 3,500 feet on the Kemapyu stream.

[1549. **Ramphalcyon capensis burmanica.** Burmese Stork-billed Kingfisher.

This common species does not appear to have been recorded from the area.]

1551. **Halcyon smyrnensis** subsp. White-breasted Kingfisher.

Previous records.—Karen Hills (Salvadori).
Specimens.—None.
Noted.—One seen at 3,500 feet on the Kemapyu stream.

1555. **Entomothera c. coromanda.** Indian Ruddy Kingfisher.

Previous records.—None before 1939.
Specimens.—Nattaung 1 ♂.
Noted.—Several birds were seen on Nattaung along streams running through evergreen, up to 4,500 feet. It is a shy bird and very fast on the wing. Not seen at Thandaung.

1562. **Lacedo pulchellus amabilis.** Pegu Banded Kingfisher.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

1563. **Dichoceros b. bicornis.** Great Hornbill.

Previous records.—Leiktho (Salvadori); Thandaung (Cook).
Specimens.—None.
Noted.—Noted along the Leiktho path in September and May. In June 1939 a bird was seen flying low over Toungoo town, a most unusual sight; it must, judging by the direction of its flight, have been crossing from the Pegu Yomas to the Karen Hills. On 12 November 1940 a flock of 17 birds was seen collecting to roost at a point on the southern slopes of Thandaung-gyi. Not seen on Nattaung.

[1567-8. **Rhyticeros** spp. Wreathed Hornbills.

Both species are likely to occur, but have not been recorded to date.]

1570. **Aceros nipalensis.** Rufous-necked Hornbill.

Previous records.—Taho (Salvadori).
Specimens.—None.
Noted.—A bird was seen feeding on fruits high up on a big tree, at 6,000 feet in the Kolo stream valley. The bright pale lilac on the face and round the eye, the grooves on the side of the bill, no casque, rufous head and neck, and white tail are diagnostic. This was the only Hornbill, and the only one of its kind, seen on Nattaung.

1580-3. **Upupa epops** subsp. Hoopoe.

Previous records.—Thandaung (Cook).
Specimens.—None.
Noted.—Seen at Thandaung on 13 November 1940.

1586. **Harpactes e. erythrocephalus.** Red-headed Trogon.

Previous records.—Taho and Yado (Salvadori); Thandaung (Cook); Karenni 4,000 feet (Wardlaw Ramsay).
Specimens.—None.
Noted.—Seen occasionally both on Nattaung and at Thandaung, up to 6,000 feet. A rather plaintive call of 6-10 notes on a monotone *tyaw-tyaw-tyaw* . . . about 2 per second, was heard in May. It is usually a very silent bird.

1588. **Harpactes oreskios uniformis.** Robinson's Yellow-breasted Trogon.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—We saw none, and it seems to be scarce outside Tenasserim.

1593-1. **Micropus pacificus** subsp. White-rumped Swift.

Previous records.—None?
Specimens.—None.
Noted.—Seen at Thandaung on 24 March (1940) and 7 October (1941).

1602. **Cypsiurus parvus infumatus.** Eastern Palm Swift.

Previous records.—Karen Hills in August (Salvadori, who described it as a new form, *Cypselus minusculus*).

Specimens.—Thandaung 1 ♀.

Noted.—Probably a casual visitor from the plains; it is very common and resident at Toungoo, but was seen in Thandaung only on 22 March and 10 October.

1605. **Chaetura gigantea indica.** Brown-throated Spinetail.

Previous records.—Karenni (Lloyd).
Specimens.—None.

Noted.—Common. Normally seen travelling at a great pace, but a small party was observed for three days in succession hawking insects over a bare ridge; the birds used to arrive at 3-4 p.m. and worked up and down a short stretch of the ridge, like a party of House Martins, disappearing at dusk. In flight the white under tail-coverts contrast with the rest of the under-parts, which appear very black.

1616. **Hemiprocne coronata.** Indian Crested Swift.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Not seen by us.

1621a. **Caprimulgus macrourus ambiguus.** Burmese Long-tailed Nightjar.

Previous records.—None before 1939.
Specimens.—None.

Noted.—Not uncommon both on Nattaung and at Thandaung up to 5,000 feet.

1626. **Caprimulgus indicus (hazarae ?).** Jungle Nightjar.

Previous records.—None.

Specimens.—Nattaung 2♂. These may or may not be *hazarae*, but are certainly not *C. i. jotaka*.

Noted.—In Burma this appears to be a scarce and local bird of the higher hills. It does not occur in the Pegu Yomas, and the only recent records are from Mt. Victoria and Kambaiti (6,800 feet, Myitkyina district). Our specimens were obtained on the top of Sosiko, 7,000 feet, and the bird was heard calling also in pine forest at 5,500 feet. The call does *not* resemble a stone on ice, and is unmistakable once heard: a steady *tuck-tuck-tuck* . . . very fast (about 5 per second) without acceleration or retardation, though one series of tucks may be uttered at a slightly faster or slower speed than the preceding one. One bird used to start calling at 6-15 p.m. from a small dense patch of trees in which it may have spent the day; it would call for about 10 minutes quite softly and would finally emerge at 6-25, just as dusk was deepening into night, with a characteristic deep *wock, wock* on the wing. It also calls in the early-morning, ceasing soon after dawn and certainly not calling after the sun had risen as the Indian race is said to do (*F.B.I.*). In the field it appears blackish, with prominent white spots on the wings and tail.

1633a. **Batrachostomus hodgsoni (hodgsoni ?).** Hodgson's Frogmouth.

Previous records.—Karenni 6,000 feet (Wardlaw Ramsay).
Specimens.—None.

Noted.—We were particularly anxious to find this bird, but saw and heard no signs of it.

1639. **Phodilus badius** subsp. Bay Owl.

Previous records.—Taho (Fea); Karen Hills (Wardlaw Ramsay).
Specimens.—None.
Noted.—Neither seen nor heard by us.

[1650. **Strix o. orientalis.** Malay Wood Owl.

The call of a large Owl, believed to be of this species was heard both on Nattaung and at Thandaung, and seen in bright moonlight on the former at 4,500 feet. The call is a melodious full-toned *who-oo-oo-oo*, uttered quickly with the stress on the first syllable.]

[1663. **Huhua nipalensis.** Forest Eagle-Owl.

A loud creaking wheezy wail *Oo-we-e-e-e-e-you*, the first part rising in pitch and a sudden drop at the *you*, closely resembling the call sometimes made by a young Owl of this species kept in captivity, was heard at Thandaung in May 1941. Wardlaw Ramsay obtained it near Toungoo, and a specimen was obtained by Mr. H. C. Smith in a forest about 20 miles north-west of Toungoo.]

1671. **Otus bakkamoena lettia.** Burmese Collared Scops Owl.

Previous records.—Karen Hills.
Specimens.—None.
Noted.—Heard calling at the Thandaung Circuit House on 9 October 1941.

1672. **Otus spilocephalus latouchii.** Eastern Spotted Scops Owl.

Previous records.—Karen Hills (Fea, 1 specimen).
Specimens.—None.
Noted.—Not seen by us.

1681. **Otus sunia modestus.** Burmese Scops Owl.

Previous records.—Chialla (Fea).
Specimens.—None.
Noted.—Heard calling in pine forest on Nattaung at 5,000 feet; the call is *tonk-tonk-tu-tonk,* repeated monotonously for long periods; the Burmese syllabify it as *Kyet-wet-chauk-gaung.*

1690-2. **Glaucidium cuculoides** subsp. Barred Owlet.

Previous records.—None.
Specimens.—None.
Noted.—A very distinctive call was heard on Nattaung at various hours (7-10 a.m., 7 p.m., and 1 a.m.) at various elevations from 4,500 to 7,500 feet, always in the densest evergreen. The call was *whooooo-tuck,* repeated, a long drawn out note ending abruptly with a drop in pitch. In the daytime the first note was considerably shortened. On 23 April I saw an Owlet with barred light brown upper-parts and no aigrettes; the chin and throat appeared unbarred, and I put it down as of this species. I chased the bird, which flew into a patch of evergreen, whence the note described above shortly issued, and I also heard it close to the same spot the previous day. We did not however hear the rippling call and other calls made by *G. c. rufescens.* The call we heard was one of the few we did not succeed in nailing to our satisfaction, and we therefore commend its study to anyone else working these hills.

1697. **Glaucidium brodei** subsp. Collared Pigmy Owlet.

Previous records.—Yado (Salvadori).
Specimens.—None.
Noted.—Not uncommon both on Nattaung and at Thandaung.

Falconidae. This is a difficult group and the obtaining of specimens largely a matter of luck. We saw several Eagles on Nattaung which we failed to identify or obtain; one of these had uniform dark brown under-parts with yellow legs, and another was a pale greyish-white bird with a white rump; they may have been Changeable Hawk-Eagles (*Nisaetus cirrhatus limnaetus*) in different phases, but the birds looked very large. No doubt many species of Hawks and Eagles occur in the area, but there are few definite records.

[1719. **Falco peregrinus** subsp. Peregrine Falcon.

I had a good view of a bird which I put down as a Peregrine on the Leiktho path on 22 October. There are no certain records from our area.]

1740–44. **Falco tinnunculus** subsp. Kestrel.

Previous records.—Karenni (Wardlaw Ramsay, who describes it as very common and thought it might breed there).
Specimens.—None.
Noted.—One seen at Thandaung on 13 November 1940 over the tea estate, and 2 or 3 birds in October 1941.

1754. **Lophotriorchis kieneri**. Rufous-bellied Hawk-Eagle.

Previous records.—Cook shot one on the top of Thandaung-gyi, the first of the only two records for Burma.

1767. **Haematornis cheela burmanicus**. Crested Serpent Eagle.

Previous records.—None.
Specimens.—Thandaung 1 ♂.
Noted.—Seen on Nattaung also; not uncommon.

1793. **Circus melanoleucus**. Pied Harrier.

Previous records.—Yado (Salvadori).
Specimens.—None.
Noted.—A bird in immature plumage was seen on passage in the tea estate at Thandaung on 8 May.

1796–9. **Buteo** sp. Buzzard.

Previous records.—None.
Specimens.—None.
Noted.—One, if not two, species of Buzzard winter in Thandaung in the tea estate, the wide open spaces of which are ideally suited to their requirements. They were usually seen perched sluggishly in trees or on one of the enormous granite boulders that litter the estate. Buzzards were also seen on Nattaung.

1805. **Astur badius poliopsis**. Burmese Shikra.

Previous records.—Karen Hills 4,000′ (Wardlaw Ramsay); Yado (Salvadori).
Specimens.—None.
Noted.—One was seen along the Leiktho path on 24 September.

1810. **Accipiter trivirgatus indicus**. Northern Crested Goshawk.

Previous records.—Meteleo, Karen Hills (Salvadori); hills north of Papun (Davison).
Specimens.—None.
Noted.—Two birds, believed to be of this species, were seen in the tea estate at Thandaung on 9 October 1941.

1818–9. **Pernis ptilorhynchus** subsp. Crested Honey Buzzard.
Previous records.—Taho (Salvadori).
Specimens.—None.
Noted.—Not seen by us.

1840. **Sphenocercus a. apicauda.** Pin-tailed Green Pigeon.

Previous records.—Taho (Salvadori); Thandaung (Cook).

Specimens.—None.

Noted.—A large party was seen feeding on figs at 4,500 feet on Nattaung, and birds were seen at Thandaung also.

1841. **Sphenocercus s. sphenurus.** Wedge-tailed Green Pigeon.

Previous records.—Thandaung (Cook).

Specimens.—Thandaung 1♀ (29-4-41).

Noted.—Not common except at Thandaung in April-May.

The bird shot had a noisy undulating flight like that of a Woodpecker.

1844. **Ducula badia griseicapilla.** Grey-headed Imperial Pigeon.

Previous records.—Thandaung (Cook). Karen Hills (type locality, Wardlaw Ramsay).

Specimens.—None.

Noted.—Not uncommon. I examined a bird that a Karen had just shot at 5,000 feet on Nattaung in pine forest. The call is *click whroom whroom*, the preliminary click only heard at close range, but the other two notes deep and resounding. It frequents chiefly evergreen.

1852. **Chalcophaps i. indica.** Indian Emerald Dove.

Previous records.—Taho (Salvadori); Thandaung (Cook).

Specimens.—None.

Noted.—Seen once or twice but not common. At Thandaung I had the pleasure of watching a female for several minutes at a range of 6 feet.

1872. **Streptopelia orientalis agricola.** Indian Rufous Turtle Dove.

Previous records.—Karenni 4,000 feet (Wardlaw Ramsay).

Specimens.—One bird shot at Thandaung on 10 October 1941 but not preserved.

Noted.—Seen on Nattaung.

1882. **Oenopopelia tranquebarica humilis.** Burmese Red Turtle Dove.

Previous records.—Thandaung (Cook).

Specimens.—None.

Noted.—Not seen by us.

1884. **Macropygia unchall tusalia.** Bar-tailed Cuckoo-Dove.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—Thandaung 1 ♀ breeding (30 April), examined by Dr. Ticehurst and 2♂ (May 1941), not seen by Dr. Ticehurst.

Noted.—Not uncommon, but possibly due to persecution they are very wary birds and difficult to observe, keeping to the tree-tops. The call-note is *croo-oom*, the second syllable being a booming note audible at a considerable distance. A rather large dark-coloured Dove compared with the next species, which is smaller and a brighter chestnut. It feeds on small fruits in the tree-tops.

1886. **Macropygia ruficeps assimilis.** Burmese Little Cuckoo-Dove.

Previous records.—Karen Hills 3,000 feet (Wardlaw Ramsay).

Specimens.—Thandaung 2♂. 1♀ (May 1941), not seen by Dr. Ticehurst.

Noted.—Fairly common. Their characteristic note was heard at intervals throughout the day in May, though the birds themselves were seldom seen. The call is *croo-wuck, croo-wuck, croo-wuck* . . . repeated very rapidly 30 times in 15 seconds with a pause of about 5 seconds and then a repetition. The *croo* is only audible at close quarters and all that can be heard from a distance of 50 yards or more is *wuck, wuck, wuck* . . . This call is usually uttered by a bird sitting bolt upright on a branch amongst thick foliage. When feeding the birds seem silent. A small Dove with a long tail and swift flight, appearing bright chestnut in a strong light.

1904. **Gallus gallus** subsp. Burmese Junglefowl.

Previous records.—Taho (Salvadori); Thandaung (Cook).
Specimens.—None.
Noted.—Heard once on Nattaung, and seen or heard occasionally at Thandaung.

1908. **Syrmaticus humiae burmanicus.** Burmese Barred-back Pheasant.

Previous records.—None.
Specimens.—Nattaung 1 ♀.
Noted.—Not seen at Thandaung. On Nattaung two parties were seen, totalling two cocks and five hens, and one of the cocks was heard drumming at 5,000 feet on 16 April. It favours dry pine ridges covered with short grass.

1925. **Gennaeus lineatus** subsp. Silver Pheasant.

Previous records.—Karen Hills (Wardlaw Ramsay).
Specimens.—Thandaung 1 ♂ (not examined by Dr. Ticehurst).
Noted.—Several parties were seen in Thandaung in November, April and May, and it no doubt breeds there. One cock seen on Nattaung.

1964. **Arborophila rufogularis tickelli.** Tenasserim Rufous-throated Hill Partridge.

Previous records.—Karen Hills.
Specimens.—Nattaung 1 ♂.
Noted.—On Nattaung it is common in parties in evergreen and temperate forest and often seen along small streams. The call is distinctive and carries a long way; it starts low and both accelerates and rises in pitch: *War* \ *war*, *war* \ *war*
etc. answered by *wick*, *wick*, *wick*, *wick* . . . Not seen at Thandaung.

1967. **Arborophila b. brunneopectus.** Brown-breasted Hill Partridge.

Previous records.—Karen Hills (Wardlaw Ramsay); Taho (Salvadori).
Specimens.—Thandaung 1 ♀.
Noted.—The specimen was obtained out of a covey of 5-6 birds at 3,500 feet in a bamboo thicket. Other coveys seen may have been this or the preceding species.

1981. **Francolinus pintadeanus phayrei.** Phayre's Burmese Francolin.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—Heard calling at Thandaung on 24 September and noted last year on Nattaung. It seems to call throughout the year.

[2003. **Turnix dussumieri.** Little Button Quail.

A very small Quail seen solitary on the Leiktho path on 7 October 1941 was probably this.]

2004. **Turnix tanki blanfordi.** Burmese Button Quail.

Previous records.—Karen Hills (Salvadori); Karenni (Wardlaw Ramsay).
Specimens.—Nattaung 1 ♂.
Noted.—Common in small parties or pairs on dry pine ridges with grassy undergrowth, and seen at Thandaung in open grassy country round the tea estate.

2015. **Rallina fasciata.** Malay Banded Crake.

Previous records.—Meteleo, Karen Hills (Salvadori, in August).
Specimens.—None.
Noted.—Not seen by us.

2025. **Amaurornis bicolor.** Elwes's Crake.

Previous records.—None.
Specimens.—Nattaung 1 ♂.

Noted.—Only the one bird was seen, in a small clearing in *ponzo* where a spring trickled onto the ground from the usual Karen bamboo aqueduct, forming a small muddy patch of a few square yards. Elevation 4,500 feet.

2030. **Heliopais personata.** Masked Finfoot.

Previous records.—Karenni (Lloyd).
Specimens.—None.
Noted.—Not seen by us.

2167. **Scolopax r. rusticola.** Woodcock.

Previous records.—None.
Specimens.—Nattaung 1 ♂, 1 ♀.
Noted.—One of the sights of Sosiko (7,500 feet) was the flighting of Woodcock at dusk from the Wrens' Paradise out into the open. In early April 6 or 7 birds were seen nightly but by 12 April only one remained, the rest having presumably migrated in the meantime. Others were seen on the Kolo and Kemapyu streams; the former was seen on two days feeding in the bed of the stream, where it ran through open country with a fringe of trees and bushes, in the middle of the day. Not seen at Thandaung.

2229–30. **Ardeola** sp. Pond Heron.

Previous records.—Karenni (Wardlaw Ramsay).
Specimens.—None.
Noted.—One bird was seen on the Kemapyu stream at 3,500 feet.

2234. **Gorsakius m. melanolophus.** Malay Bittern.

Previous records.—None.
Specimens.—Nattaung 1 ♂.
Noted.—Obtained on the Kemapyu stream where it runs through evergreen; one if not two others were seen on the same stretch but after a day or two they departed, probably resenting disturbance.

2239. **Dupetor f. flavicollis.** Black Bittern.

Previous records.—Taho (Salvadori).
Specimens.—Nattaung 1 ♂.
Noted.—The only one seen was obtained at 3,500 feet on the Kemapyu stream.

(To be continued)

BREEDING HABITS AND EARLY STAGES OF THE GOURAMI (*OSPHRONEMUS GORAMY* LACEPEDE).[1]

BY

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(*With seven Text-figures*).

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INTRODUCTION.

The cultivation of gourami as a substitute for marine fish where this is not readily available, is being increasingly undertaken in tropical countries, including India. Literature on the bionomics of the fish is thus always growing. Papers describing aspects such as the nesting, breeding and feeding habits of the fish have, from time to time, been published by various authors, including Carbonnier (as quoted by Jones), Gilbert (1894), Jordan (1905), Sundara Raj (1916), Villadolid (1936), Roxas and Umali (1937), and Jones (1939). The last-mentioned paper shows that as late as 1939 there was considerable misunderstanding regarding the nest building habits of gourami. Further, the papers compiled by the Philippine authors

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[1] The Genus '*Osphromenus*' (Commerson) Lacépède mentioned by Day (p. 369) is probably a misnomer. According to Max Weber (p. 344) Lacépède described genus *Osphronemus* and not *Osphromenus*. *Osphronemus goramy* Lacépède and *Osphromenus olfax* (Cuv. & Val.) are, however, synonyms and Lacépède's name is retained because of its priority.

Villadolid (1936) and Roxas and Umali (1937) which give exhaustive information on the breeding of gourami, are not quite complete, as they omit certain details about the nesting habits and descriptions of early larval stages. The form described as a newly hatched larva by Roxas and Umali (op. cit.) is, according to the present author, a fry 10 days old. Moreover, there are three earlier stages of the larva which have, apparently, not been recorded so far. It is hoped that observations recorded in this paper will remove certain misapprehensions about the earliest stages of the fish and be of some help in furthering our knowledge of gourami, which has of late been increasingly popular.

ACKNOWLEDGEMENT.

The author takes this opportunity of expressing his best thanks to Dr. S. B. Setna, Fisheries Officer, for his valuable guidance and constant encouragement at every stage of the investigation.

BREEDING HABITS OF *Osphronemus goramy* LACÉPÈDE.

Breeding Season.—A fairly representative account of the breeding habits of gourami is given by Villadolid, who, in a memoir published in 1936, observes as follows:—

> 'From time immemorial the gourami has been pond-raised in Java. According to Mr. Delsman, of Batavia (Delsman, 1926) the gourami in Java make their nests nearly the whole year round, but most frequently in July and August. He further states that the wet season is the least favourable. According to Theodore Gill (1874), however, the spawning season of gourami in Mauritius and Bourbon falls in the autumn (March and April) and spring (September and October). In the Philippines spawning gourami were first noticed in the Bureau of Science ponds in April 1930. Gourami reared in the Escudero farm were reported to have spawned for the first time in September 1934. The indications are that gourami may spawn at any time during the year.'

Sundara Raj (1916) states that the breeding season in Java is March and in Madras about May, but in the official bulletin of the Department of Fisheries, Madras, dated December 8, 1939, he describes gourami as breeding twice a year, in February and March and again in September to November. Roxas and Umali (op. cit.) affirm that the fish breeds throughout the year and Aquino (1935) also concurs with them. In Bombay, however, my observations during the past four years have shown that the fish breeds throughout the year except during the monsoon from June to September. The interruption in breeding may be due to the rapidly changing levels of ponds at this time, which makes it difficult to build a nest at a particular depth from the surface. The peak period of breeding being April and May. These observations appear, in some degree to be corroborated by those of Roxas and Umali (1937), who state that 'The peak of the breeding season occurs during the warm months from March to May'. There is one instance however, when fry of Gourami were found in one of the ponds in Bombay as early as November. The fry, which measured about 1½ in. to 1¾ in. in length, were first noticed in November, 1941.

To attain this size the fry must have hatched at least 2 months previously, i.e. in August or September. A factor which may perhaps explain this apparently unseasonal hatching of the fish is that scarcely any rain fell after the middle of August. The level of the pond must have been almost static and this comparatively still condition of the water must have induced the fish to build its nest and to breed earlier than usual.

The varying records of breeding habits, although from different quarters of the Asiatic continent, are from nearly the same tropical climatic zone, and provide no obvious reason for the disparity in the characteristics of the gourami. Even in India there is no agreement between the records from Bombay and Madras. The fish is known not to breed in Madras during the cold weather.

As a matter of fact, the cold weather at Madras is not so sharp as to inhibit this activity. If low temperatures were at all to bring about such an effect, it should have been more pronounced in the Philippines, where, on the contrary, the fish has been observed to breed throughout the year. The climate of Bombay does not vary greatly from that of Madras, and accordingly the habits of the gourami should manifest greater similarity than divergance at these two places.

Material for the nest.—Gourami is fairly well known for its habit of building a nest in the water for the reception of its eggs. Sundara Raj (op. cit.) who described the habits of gourami, quoted Jordan's view (1905 p. 369) that 'the nest was of a spherical form, composed of plants, preferably tufts of a peculiar grass (*Panicum jumentorum*) which grows on the surface of the water'. He gives, however, in the administrative report of the Madras Fisheries Department for 1932-33 a list of quite different hydrophytes which are used to build nests. Roxas and Umali (op. cit.) give yet another list of plants and articles used for this purpose and state that 'it (nest) is composed of plants, mud and other available floating and submerged material'. The authors have rightly noted that the fish uses for its purpose whatever is available in the pond. It is unnecessary to introduce in a pond the typical grass and materials which the gourami might previously have used for nidification. Once the fish has chosen a particular material, it always manifests an instinctive preference for it as long as it is available. This was well illustrated in a tank at Bandra, Bombay Suburban District, where the gourami always employed hitherto unlisted material to build nests in preference to other commonly used plants. Observations of the fish bred in the tank during the last four years show that gourami manifests a special preference for long peals and fibres of lotus stocks (*Nelumbium* sp.) left over in the pond after the decomposition of the pulp, although the tank may be and is actually littered with such common hydrophytes as *Ceratophyllum, Hydrilla,* etc., which are generally recorded as plants used in nests built by this fish. Probably, the softness of the lotus fibres, their binding qualities and the ease with which they may be carried through the water makes the first choice with gourami for nest building. *Ceratophyllum* and *Hydrilla* were used by the fish to only a limited extent. *Ipomea, Pistia, Potamogeton,* *Eichhornia*, and *Limnanthemum*, though available in the pond, were rarely utilised. These plants, along with some fibrous roots and tufts of grasses, were used by the fish for nidification in other ponds. This fact proves that gourami has definite likes and dislikes in regard to the choice of material for the building of its nests. The fish does not, however, limit itself to any particular material, so that when occasion arises it can build its nest from whatever material is available.

Site for the nest.—As the breeding season approaches, the parents search for a site for a nest. The place selected is generally at the edge of a pond, but an additional factor in the choice of a site is that the selected place should have ample free space below the nest so that the fish can go right below to lay eggs and also to produce currents in the water by moving it with the fins. For this reason steeper sides of ponds lined either by irregular stones and crevices or by firm grass affording support to the nests are generally favoured. Sides of ponds with gradually sloping banks are not quite suitable. Such sites, although unfrequented by people and affording the necessary stillness, were found to have been disregarded by the fish in preference for steeper sides, although these adjoined busy thoroughfares. In the Administration report of the Madras Fisheries Department for 1933-34, Sundara Raj while describing the habits of gourami in the construction of nests observes 'to begin with they scoop a hole in the muddy margins of the pond among the grass or bulrush'. This habit of making a hole may as well be for the same purpose of securing space below the nest as pointed out above. Nests have also been observed in the centre of the ponds wherever rocks or any other structures held out suitable support near the surface of the water. Nests have also been found hung on the entangled shoots of *Ceratophyllum* right in the middle of tanks, and their secure position in such surroundings was due to their being intertwined with lotus stalks. In Java tufts of fibres of palm, *Arenga saccharifera* are suspended in ponds to induce the fish to build nests in the tufts. In Madras the same practice has been reported to be successful at some places (1933-34). Roxas and Umali (op. cit. page 442) record nests built in the floating roots of *Eichhornia* in a cement concrete tank in Manila. It should be remembered, however, that such precarious places as the floating roots would be used by the fish only as a last resort when nothing better was available. The ready manner in which the fish adapted itself to the unfamiliar conditions and exploited them to the utmost advantage was indeed noteworthy.

Nest:—To start with, the parents carry the building material in their mouths and fix it on the selected spot with the help of their thick snouts. If a crevice between stones is to serve as a starting point the material is firmly rammed into it, and additional material is entangled to form a nest. As with the nests of birds, the softer material on which the eggs are deposited is placed in the centre. The nest is generally about half a foot below the surface of water or at times even touches it. The opening is usually on the lower side or slants slightly towards the centre of the pond. According to the Philippine authors the fish takes about a week to build the nest. Sundara Raj's observations show, on the other hand, that it takes about a month to complete.

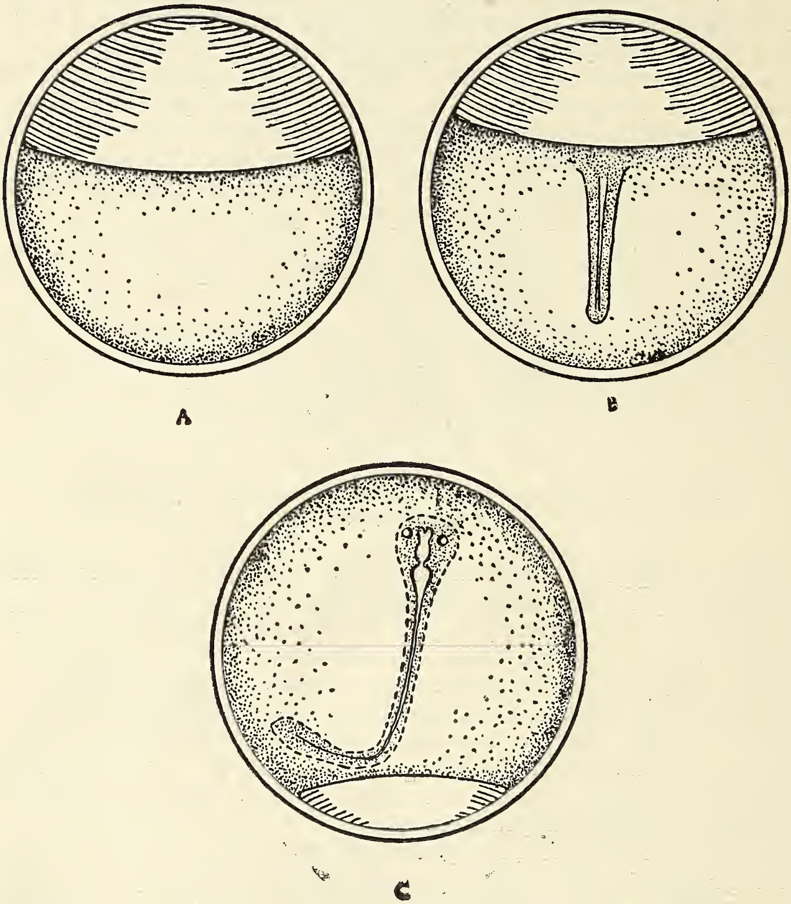
The size and shape of the nests do not appear to be uniform in all cases and depend mostly on the size of the fish and material of which it is made. It can, however, be said to resemble a bird's nest. Occasionally when the building material is merely wedged in between stones on the border to obtain a support, the nest becomes more elongated or drawn out and has no particular shape. If the material is not very pliable and if the support is firm and easy, the nest becomes compact and shapely. The one observed at Sunkesula farm (Madras) in March, 1937, was made of roots of bulrush and dried blades of grass and appeared quite elegant—almost like a bird's nest. 'The nests' described by Sundara Raj (1932-33) 'measure 6 inches in diameter 7 inches in height'. Roxas and Umali (op. cit.) record bigger nests of about 30 cms. (12 inches) in length and 18 cms. (7.2 inches) in width, but our observations showed that most of the Bombay nests were bigger than the Philippine nests and measured on an average about 15 in. in length and 12 in. in diameter and were placed lengthwise in the ponds.

EMBRYOLOGY AND LARVAL DEVELOPMENT OF *Osphronemus gorami*.

Eggs.—Eggs are laid in batches. The female goes below the nest, inspects it, then lies on her broad side, lays a cluster of eggs and retires. The male waiting close by then discharges his semen on the eggs to fertilize them and withdraws. This process is repeated several times till all the eggs are laid. A few fibres are then pulled out from the sides of the nest, and the eggs covered with them, so that they are well protected and no intruder can have access to them. Both parents guard the nest in turn, inspect the eggs occasionally and stir the water with their fins to produce a current to help oxygenation.

Records from the Philippines, as well as from Madras show that gourami is known to lay about 800 to 1,000 eggs at a time, but my observations show that the number of eggs laid at a time may be much bigger. On February 21, 1940, a nest in the Bandra tank was found to contain about 3,000 larvae, which had just hatched out, all being nearly of the same age. This observation led the investigator to assume that the eggs might have been laid not only by one but two or more females. This assumption proved, however, to be incorrect as in the subsequent year two other nests in the same tank on April 17, 1941, had each about 2,200 and 2,000 larvae. This fact makes it clear that gourami at least in the pond at Bandra lay eggs prolifically.

The eggs are of a fine lemon yellow colour, glistening remarkably on top owing to a quantity of oil at the upper pole, which occupies more than 1/3 the size of the egg and is comparatively very large. The diameter of the egg is about 2.2 to 2.4 mm. Due to the large quantity of oil in the globule the eggs are buoyant if left free but being always in the nest they are never seen floating in the water. They are very soft, delicate and unadhesive. The egg membrane, being very tender, collapses even if slightly touched (fig. 1. *a*).

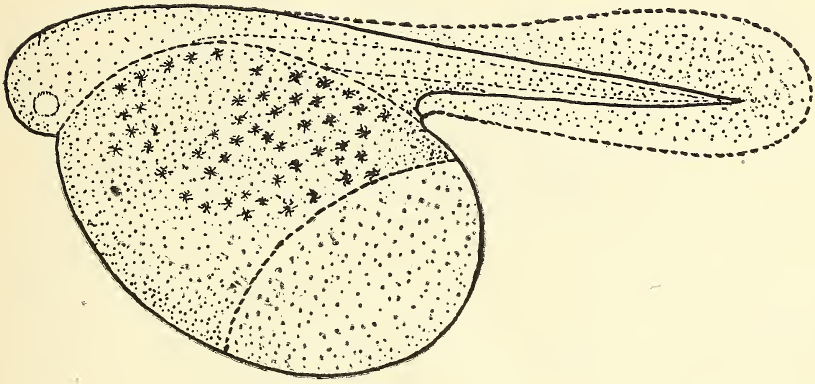


Text-fig. 1.—Egg and early embryonic development of *Osphronemus goramy* (Lacépède) × 18.

(*a*) Egg. (*b*) Egg with embryonic ridge. (*c*) Egg with developing embryo.

'The eggs hatch in about 10 days', according to Roxas and Umali, and in about 15 days according to Villadolid. The time varies, however, according to the season, being shorter in summer and longer in winter. Figures 1b and 1c in the text represent some of the embryonic stages. Fig. 1 *b* shows only the embryonic ridge being formed, while fig. 1 *c* represents an embryo with the cephalic region in the process of formation and the optic region marked out. The caudal portion is also complete.

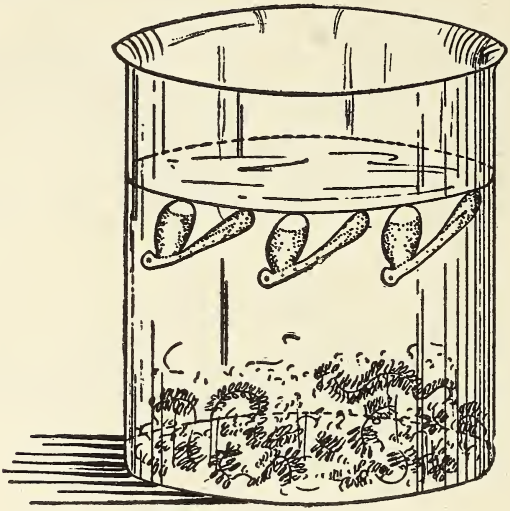
Newly hatched larva.—Roxas and Umali (op. cit.) record newly hatched fry as being 9 mm. in length and describe it as follows. 'A newly hatched fry is about 9 mm. long, the body being somewhat elongated. The head measures 5 times in the total length, while the eye is contained 3 times in the length of the head. Although somewhat short, the caudal fin in fully formed. Only the beginning of the soft dorsal and anal fins are evident as fleshy projections, there being as yet no distinct ray formation. The pectoral and the ventral fins are entirely absent, although fleshy indications of the former are already visible. The pigmentation is still wanting except as scattered patches in some parts of the head and body'. My observations show that the first hatchling of Gourami (fig. 2) is much smaller and quite different from what has been described above.



Text-fig. 2.—Newly hatched larva of *Osphronemus goramy* (Lacépède) × Ca. 20.

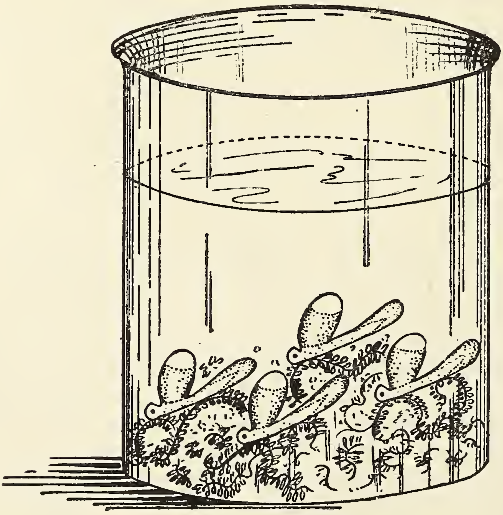
Its (newly hatched larva) total length is about 5.3 mm. It has a comparatively large yolk-sac of about 3 mm. in length and 2.0 mm. in breadth and the latter is closely attached below the head by the longer axis. The length of the head is contained about nine times, and the height about 8.5 times, in the total length of the larva. The anterior end (snout) is almost rounded. The mouth is not perceptible. The sclerotic coats and the lenses of the eyes are developed, but there is no pigmentation as yet. The pectoral and ventral fins are not developed at all. The dorsal, caudal and the anal fins also are not present, but, in their stead, a thin vertical fold starts dorsally from about 1/3 the total length of the larva from the head and is continued ventrally round the caudal end to meet the yolk-sac at about half the total length. Two or three small chromatophores are seen on the dorsal side of the larva posterior to the head, and numerous ones of the same size are distributed on the yolk-sac dorsally and posteriorly. These chromatophores are not visible to the naked eye and can be seen only through a magnifying lens. The oil globule is yet persistent and is quite visible, occupying the rear end of the yolk-sac.

A remarkable feature about the newly hatched larva is the manner of its suspension immediately below the surface of the water. The larva at this stage assumes a supine position with its tail directed upwards and forms an angle of about 30 degrees with the plane of the water (fig. 3).



Text-fig. 3.—Early hatchlings floating in inverted position (diagrammatic).

The concentration of oil at the end of the postero-ventral side of the yolk-sac perhaps acts as a buoyant agent which causes the larva to float towards the surface film of the water. The larva at this stage is almost quiescent and, unless disturbed, prefers to remain motionless near the surface. On disturbance it swims away swiftly in the same inverted condition and again resumes its original position elsewhere. In the natural environment this quiescent stage is always passed in the nest and the larva does not come to the surface of the water in spite of its buoyancy.

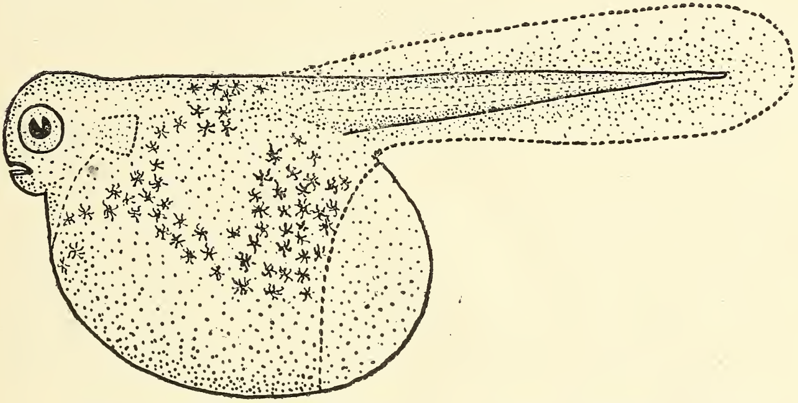


Text-fig. 4.—Early hatchlings attached to weeds under water (diagrammatic).

Two-day old larva:—Late on the second day pigment begins to appear in the eyes. Fleshy indications of the pectoral fins and a minute slit in place of the mouth are also visible. An interesting fact noted at this stage was that, despite the buoyancy due to the oil globule, the larva descended to the bottom of the observation tank and rested on the weeds, the general appearance of its position being the same as when it was floating immediately under the surface film of water (fig. 4).

Cement glands such as those recorded by Jones (1940) on the head and nape of *Macropodus cupanus* (Cuv. & Val.) and on *Etroplus* by the same author (1938) appeared to be absent from the head of the larva of gourami.

Four-day old larva:—On the fourth day the larva (fig. 5) has the usual pigmentation in the eyes and the oral slit is replaced by a normal mouth. The pectoral fins also have assumed shape, but there is no ray formation in them.

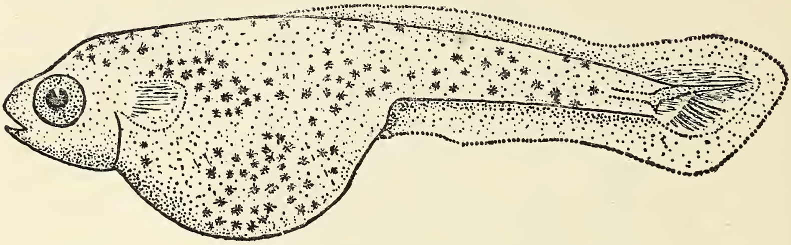


Text-fig. 5.—Four days old larva of *O. goramy* (Lacépède) ×Ca 16.

The larva is about 6.4 mm. in total length, with a yolk-sac of nearly the same size as on the first day. The head is contained about 8.5 times in the total length and the eye only about twice in the length of the head. The dorsal, caudal, anal or ventral fins are not developed. Only the vertical fin fold is present as before. The position of the vent is somewhat defined. A small pulsating heart, with coursing red blood corpuscles is visible below the throat. The chromatophores increase in number and occupy wider areas on the body.

On the fourth or fifth day the larva corrects its inverted position and swims in the normal manner of a fish. The movements are greatly restricted, however, and the larva prefers to shelter in the entangled fibres of the nest or on the bunches of *Ceratophyllum*, amongst which it remains motionless for a day or two. The duration of different stages depends on the conditions in the observation tanks. Some of these stages are earlier if conditions are favourable and later, if otherwise.

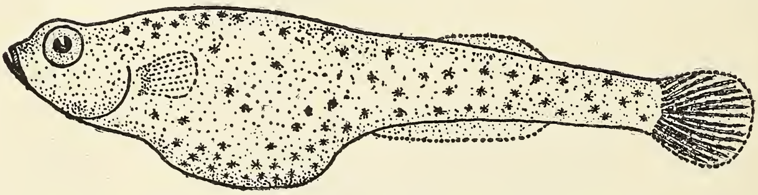
Seven-day old larva.—The larva acquires after about seven days a fish-like appearance, with its characteristic snout, eyes, trunk and tail (fig. 6). It is about 7 mm. in length and has an elongated form.



Text-fig. 6.—Seven days old larva of *O. goramy* (Lacépède) ×Ca 14.

The yolk-sac is not absorbed, but appears to be partially incorporated 'in situ' in the body of the larva. This makes the anterior half of the body thick and the caudal portion slender. The head is contained about 7 times in the total length of the fish and the eyes are proportionately of the same size as in the former stage. They are prominent and are oblong as in many larval forms. The height of the head is slightly more than its length. The snout is bluntly pointed and is about ½ the antero-posterior diameter of the eye. The height of the body is contained about 3.5 times in the total length. The membranous pectoral fins are clearly marked out. The vertical fin fold has proportionately the same length as was described in respect of the newly hatched larva and extends round the caudal end. The positions of the dorsal, caudal and the anal fins are, however, roughly marked out by the margin of the vertical fold sinking and approaching the body at spaces intervening between the fins concerned. The caudal fin appears to develop more rapidly and the rays appear in the process of formation. The ventral fins are as yet completely absent. The Chromatophores, which have increased both in number and size, are distributed all over the body, including the caudal region. They are more numerous on the ventral surface (yolk-sac) and on the head. The number of these chromatophores is not, however, sufficient to lend any general colour to the larva which, to all purposes, appears almost white to the naked eye.

Ten-day old larva.—The characteristics of the larva (fig. 7) when it is 9 or 10 days old generally tally with the description



Text-fig. 7.—Nine days old larva of *O. goramy* (Lacépède) ×Ca 11.

given by Roxas and Umali (op. cit.) of newly hatched fry (*vide* infra p. 238. In some respects, however, even their description would seem to require certain modifications.

The two authors (loc. cit.) record, 'The pectoral and the pelvic fins are entirely absent, although fleshy indications of the former are already visible'. My observations have shown (*vide* infra p. 241) that the fleshy indications of the pectorals are visible on the second day, when they are quite distinct and well developed. Another point of difference is that although the rounded abdomen of the larva appears to these authors as a portion of the original yolk-sac, yet it would not be proper in my opinion to consider the yolk-sac as still in existence, because it has by now been almost incorporated in the body of the larva.

A description of the later stages of Gourami is not included in these notes as the same has already been fully dealt with by Roxas and Umali.

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SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

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(*With three plates*).

(*Continued from page* 477 *of Vol.* xliii, *No.* 3).

XI.—*Heliotropium zeylanicum* Lamk.

(Boraginaceae).

SYNONYMY AND SYSTEMATIC DESCRIPTION.

Heliotropium zeylanicum Lamk. Encycl. Method iii, 94 (not of Wall., nor of H. F. B. I.); Duthie Fl. upper Gang. Pl., II, 93; Gamble, Fl. Pres. Madras, Pt. v, 896. Syn: *Heliotropium paniculatum* R. Br. Prod. 494 (not of Roxb.); H.F.B.I., IV, 151; Cooke, Fl. Pres. Bomb., V, II, Pt. 1. 212. *Heliotropium linifolium* Lehm.; Wt. Ic. t. 1391.

An erect herb, 1-2 ft. high, with stout root stock and numerous ascending branches; stem and branches more or less strigose or sometimes quite glabrous. Leaves alternate, nearly sessile, linear, very narrow, acute, clothed on both sides with appressed hairs or the upper surface glabrous, margins recurved. Flowers shortly pedicellate, in slender simple or forked racemes; bracts linear, hairy. Calyx 5-partite, strigose outside. Corolla hairy outside, limb white, tube yellow; lobes ovate-deltoid, with plicate sinuses between. Stamens 5, inserted rather low down in the corolla tube; pollen cylindrical with longitudinal ridges and furrows. Style very short, stigma conical, a little longer than the style, stigmatic ring conspicuous. Ovary more or less perfectly 4-celled, ovules 1 in each cell. Fruit sub-globose, nutlets hairy on the back, acute at the apex. (plates I and II). Flowers June to September.

Habitat.

S. Deccan and Ceylon (Hooker, 3); not very common in the Bombay Presidency (Cooke, 1); confined to the N.-W. portion of Gangetic Plain (Duthie, 2); very common in Hyderabad, growing in patches (Plate I, Fig. 1), (Sayeedud-Din, 6).

Distrib.—S. India, Ceylon, Siam and Australia (Hooker, 3).

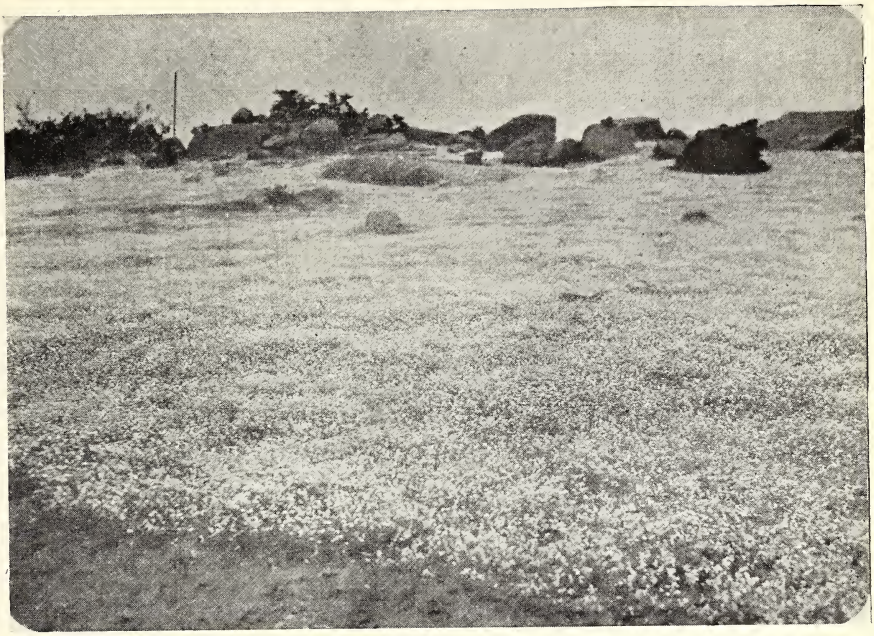


Fig. 1.—An association of *Heliotropium zeylanicum* Lamk.

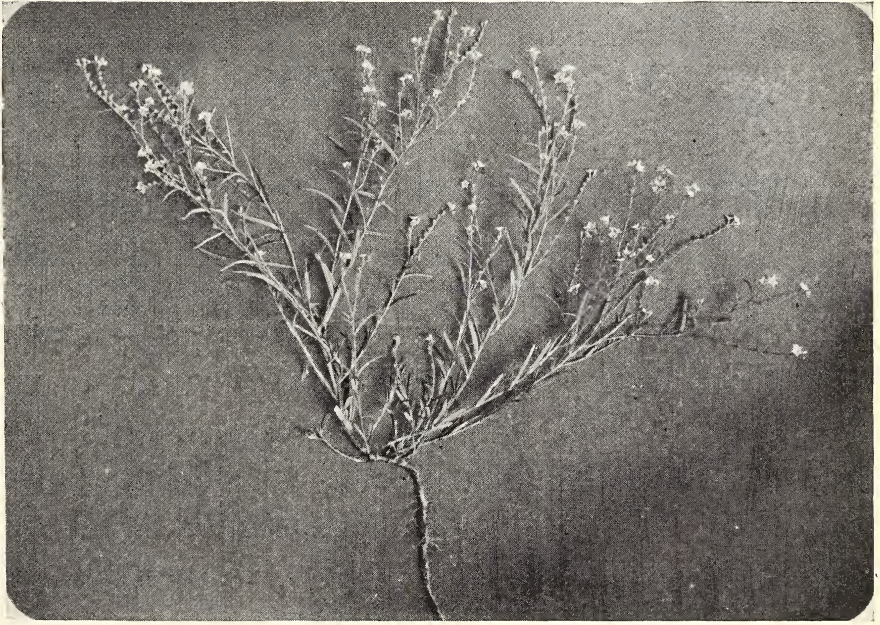
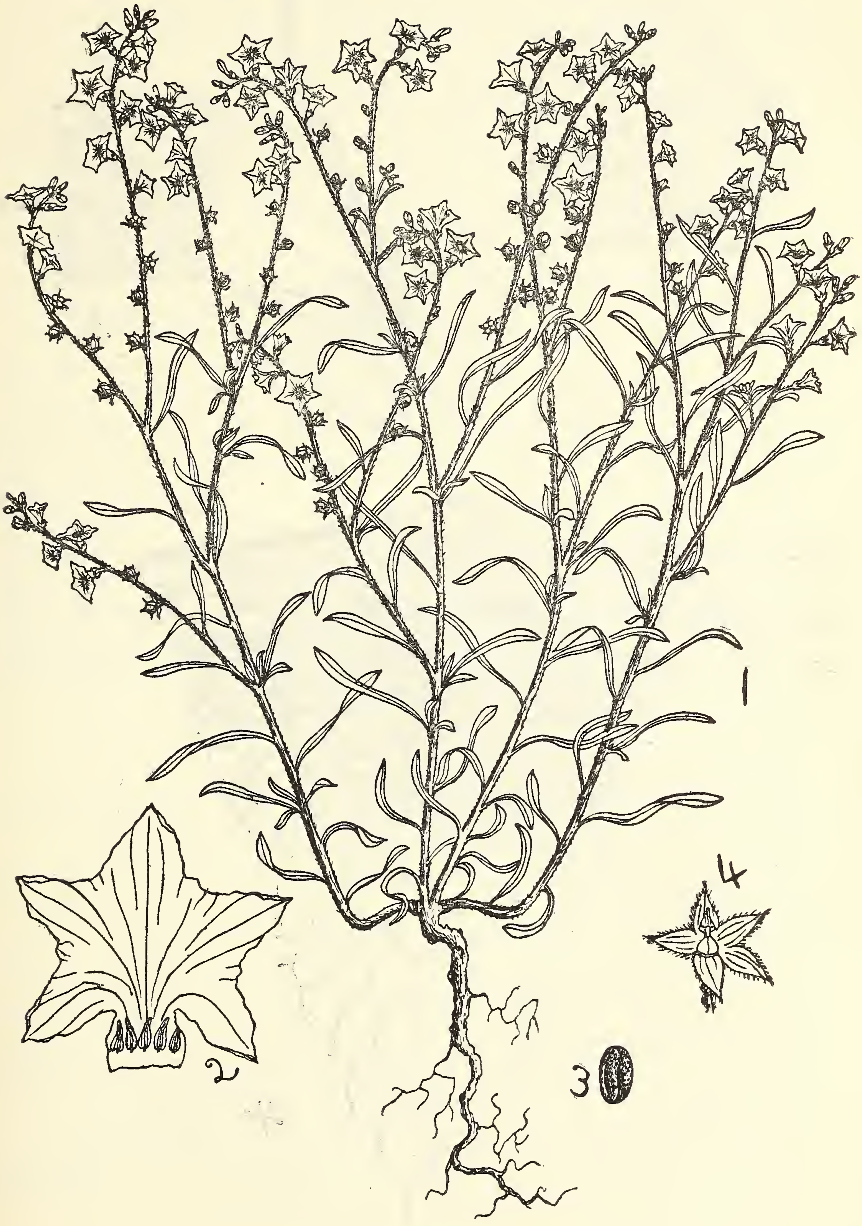
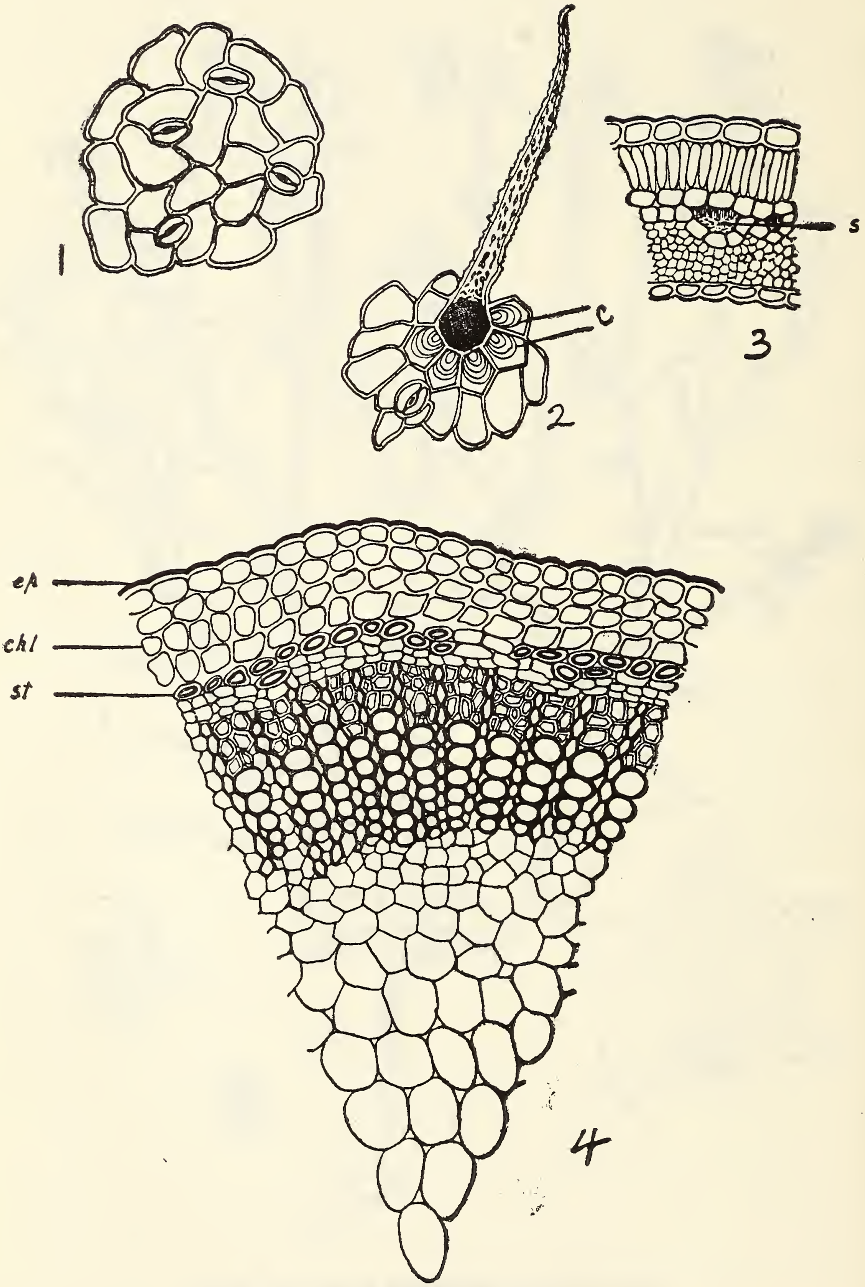


Fig. 2.—*Heliotropium zeylanicum* Lamk.



Sayeedud-Din : **Heliotropium zeylanicum** Lamk.

[*For explanation see end of article.*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Sayeedud-Din :—**Heliotropium zeylanicum** Lamk.

[*For explanation see end of article.*

ANATOMICAL NOTES.

Structure of the leaf. (Plate III, Figs. 1 and 3). The epidermis consists of large cells with their outer walls greatly thickened, and arched convexly outwards. The stomata occur more on the lower than on the upper surface. They do not belong to any special type, but, according to Strasburger and Vesque (Solereder, 7) they belong to the Cruciferous type which is frequently obscured. Hence no special arrangement of the epidermal cells around the guard-cells is recognizable. The mesophyll consists of palisade tissue on the upper side and of arm-palisade tissue on the lower. Sabnis (5) records the same in *Heliotropium supinum*, *H. paniculatum* Linn., *Trichodesma indicum*, and *Arnebia hispidissima.*

Internal secretory organs occur in the form of cells containing tanniniferous contents in the middle of the mesophyll.

Oxalate of lime is present in the form of solitary crystals in the leaf as well as in the axis.

The clothing hairs on the axis and the leaves are unicellular, elongated, and gradually tapering towards the apex. Their walls are verrucose, and in many a cystolith-like body is developed in the basal portion which is bulbous. (Plate III, Fig. 2). Glandular hairs are not present.

Structure of the axis. (Plate III, Fig. 4). The epidermal cells are large, with their outer walls thickened and cuticularised. The primary cortex consists of colourless parenchyma, and chlorenchyma. The endodermis possesses granular contents. Scattered groups of stone-cells occur in the pericycle. The pith consists of thin-walled cells with granular contents.

CONCLUSIONS.

The anatomical study of *Heliotropium zeylanicum* Lamk. reveals the following characteristic features :—

1. Stomata do not belong to any particular type.
2. Oxalate of lime occurs in the stem and leaf in the form of solitary crystals.
3. Cystolith-like bodies are developed in the basal bulbous portion of some of the clothing hairs.
4. The clothing hairs are unicellular, elongated and verrucose. Glandular hairs do not occur.
5. Internal secretory organs occur in the form of cells holding tanniniferous contents in the middle of the mesophyll.
6. The mesophyll consists of palisade tissue on the upper side and of arm-palisade tissue on the lower.
7. In the axis, scattered groups of stone-cells occur in the pericycle.

ACKNOWLEDGEMENTS.

I am thankful to Mr. Sri Ramloo for preparing the photograph and the drawings.

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EXPLANATION OF PLATES I-III.

Heliotropium zeylanicum Lamk.

PLATE I.

Fig. 1. Photograph of an association of *Heliotropium zeylanicum* Lamk.
Fig. 2. Photograph of a single plant.

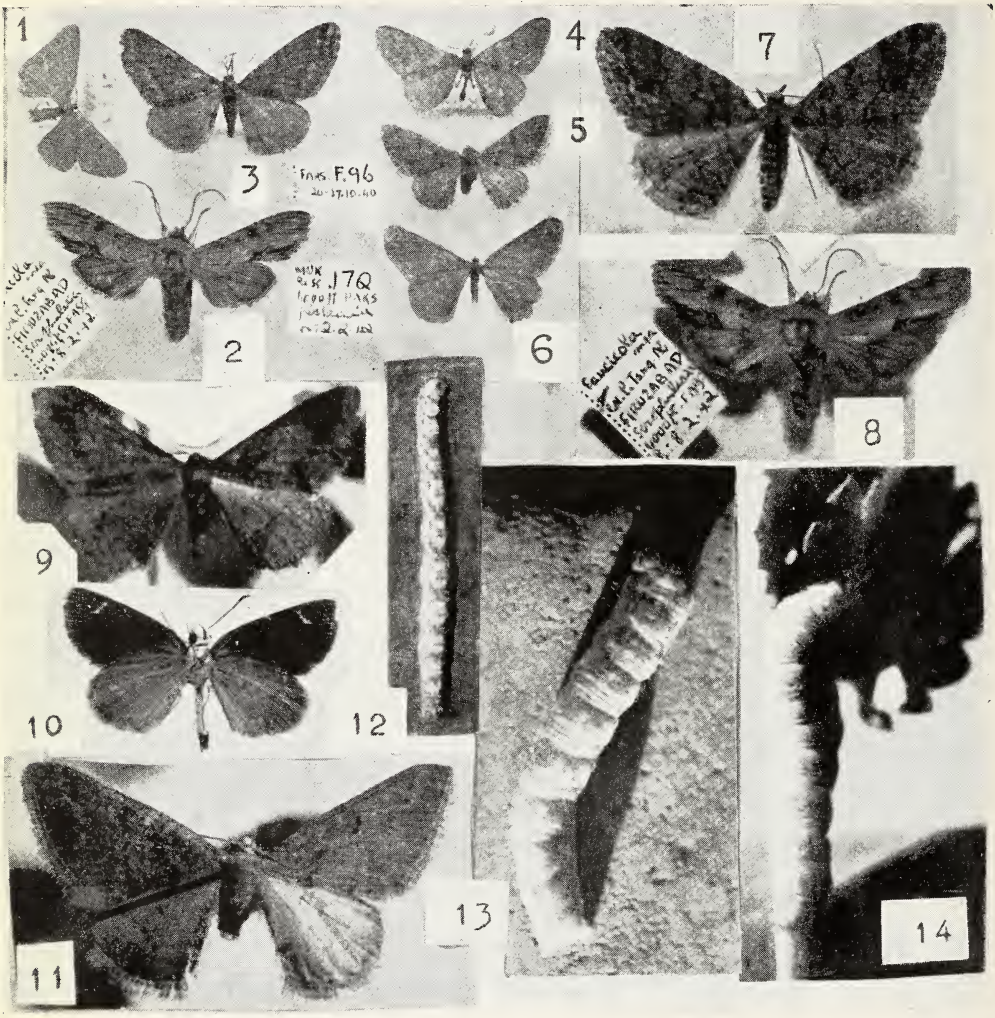
PLATE II.

Fig. 1. Black and white drawing of *Heliotropium zeylanicum* Lamk. (Nat. size).
Fig. 2. Corolla opened out. (x 10).
Fig. 3. Pollen grain. (x 300).
Fig. 4. Pistil with calyx attached. (x 10).

PLATE III.

Fig. 1. Leaf-epidermis, showing stomata. (x 300).
Fig. 2. Trichome, showing the cystolith-like body in the basal bulbous portion. (×300).
Fig. 3. T. S. Leaf, showing, s, secretory cell containing tanniniferous contents. (x 300).
FIG. 4. T. S. Stem, showing, ep, thickened epidermis; chl, chlorenchyma in cortex, chloroplasts not shown; st, stone-cells in the pericycle. (x 300).

Some more New Lepidoptera from S. W. Iran.



Figures 1-6 are on same scale and show comparative size and shape of various Fars "winter moths". Fig. 1. *Epitherina rhodopoleos* Wli., pale specimen. Fig. 2, 8. *Cucullia faucicola* Wilts., type, ♂. Fig. 3. *Erannis* probably *bajaria* Schiff., ssp. ♂. (Fars, November). Fig. 4, 5, 11. *Heterobapta plumellata* Wilts., types, ♂ ♀. Fig. 6. (?) *Erannis bahmana* Wilts., type, ♂ Fig. 7. (?) *Epitherina pistaccioe* Wilts., type, ♀. Fig. 9. *Hemerophila engys* Wli., type, ♂ (Berserini, Kurdistan, October). Fig. 10. *Eogenes alcides clama* Wilts., type, ♂ underside (Maidan-i-Naftun, 6.V.1938 : See "Mesopotamian Desert Lepidoptera", Journ. Bombay Nat. Hist. Soc. Vol. XLII. No. 4. Dec. 1941. p. 833). Fig. 12 (?) *Erannis bahmana* larva. Fig. 13, 14. *Cucullia faucicola* larvae (Fig. 14 also shows food-plant leaf.)

SOME MORE NEW LEPIDOPTERA FROM S.-W. IRAN,

WITH THEIR LIFE HISTORIES

By
E. P. WILTSHIRE, F.R.E.S.

(*With a plate*).

A previous article ('New Lepidoptera from S.-W. Iran, *Journ. Bombay Nat. Hist. Soc.*, Vol. xlii, *Aug.* 1941) introduced various new species taken in 1940 in Fars, and mentioned that others were still *sub judice.* One of these is now here brought forward, together with three other new species bred from caterpillars found in Fars in 1941.

The present article, dealing with the life histories of the three latter, may be considered as No. 6 in my series 'Early Stages of Oriental Palearctic Lepidoptera', of which No. 5 appeared in *Journ. Bombay Nat. Hist. Soc.*, Vol. xliii, p. 621, April 1943.

I am indebted for useful advice to Mr. Louis Prout regarding the three Geometridae here described; he has examined a paratype of one of them and seen photos of the others. The genera, to which the two latter are here tentatively attributed, have not yet been authoritatively diagnosed; but since there is little doubt that the species are new, and the early stages can be described and illustrated, I felt it perhaps permissible to publish the discoveries to the best of my present ability, rather than, by waiting till the end of hostilities, run the risk of losing both the material and my records of it. Present world conditions naturally prevent international consultation of the sort possible and advisable before such a publication in peace time.

The present paper, however, by no means exhausts the tally of new species which could be brought forward from my Fars material. In particular, I have in mind a *Crocallis* and an autumnal *Chilena* (?), of whose early stages also I have notes and photos. I omit them here because I have been given to understand by Dr. Wehrli that W. Brandt has described or will shortly describe the former, and, in the latter case, because I have not been able to consult a Bombycid-specialist and I lack a male specimen too.

The plate illustrating the new species here described also illustrates the larvae of two of them and in addition illustrates the types of two previously described species or forms from my collection, and two Fars 'winter moths' for comparison with the three Geometridae here described.

The previous article mentioned in the first paragraph above should be consulted by readers interested in the floristic character of the Fars mountains where these discoveries have been made.

Cucullia faucicola sp.n.

In introducing this distinctive addition to the *lychnitis-verbasci* group of the genus *Cucullia,* a few words on the distribution of the group will not be amiss.

The group is characterised by a similarity in facies of the adult, by the strictly vernal phenology of the moth, by association of all its members with *verbascum* or *scrophularia* as foodplant, by the comparatively small difference discernible in the male genitalia of its different species, by the specific distinctiveness of the larvae, and by the occurrence of distinct species with a limited range scattered here and there over the wide range of the two commonest and most generally distributed species, viz. :—*lychnitis* Ramb. and *verbasci* L.

From India I know of only one species having been previously recorded, namely *stigmatophora* Hamps., which is probably a close relative of *faucicola*; the type of the Indian species was taken at Simla. But I am able here to add for India a second species of this group, namely the common species *verbasci* L. which ranges from the Atlantic to the Pacific of the Old World; I observed its unmistakable larvae on *verbascum* in Kashmir at 5000 to 7000 ft. in May-June 1942. For the differences between *stigmatophora* and the Central Asian species *notodontina* Bours. and the Trans-Caspian species *Zerkowitzi* Bours., see Boursin—'Contribution à l'Etude des Noctuidae-Trifidae, No. XII' (*Revue Française d' Ent.*, 1 (1934). Quite possibly *lychnitis* also occurs in Palearctic India.

In the Middle East, the group is represented by both *lychnitis* and *verbasci*, and a number of more local species :—*lychnitis* occurs from the Mediterranean coast-level up on to mountains and plateaux of the hinterland, usually accompanied by *verbasci.* These two species have not been noted from the low lying Mesopotamian desert, which however produces the rare species *strigicosta* Bours., so far only taken from the Khaniqin region of Iraq. Both the commoner kinds occur in North Persia, but in the south of that country some climatic factor seems to limit their range, for I failed to find *verbasci* at all in Fars, and only found *lychnitis* in Fars in the 7,000 ft. high region of Ardekan, which is the southernmost point to which many species distinctive of the Middle East reach on the Zagros range. *Barthae* Bours. ranges from the Elburz range through Anatolia and Syria to Italy. *Xylophana* Bours. only occurs in Central Asia, together with *notodontina,* while *anceps* Stgr., originally described as ranging from Syria and Turkey as far as Turkestan has yet to be proved to occur so far afield, and at present it is best described as a species confined to the high mountains of N. Persia, Syria and Turkey. *Osthelderi* Bours. is only known from the Taurus Mts., Turkey. The mention of the other local Palearctic members of the group that occur further west is not necessary here.

Faucicola is easily distinguished in the imago from all the foregoing species and from the more westerly members of the group also by the clear delineation across its forewing of both the ante-median and post-median lines. It resembles *stigmatophora* in that the orbicular stigma is clearly visible by its paler colouring against a greyer background, but differs in that its reniform stigma is similarly clearly visible. Its larva is also easily distinguished from all the Midde East species of which the early stages are known; its nocturnal habits separate it from all others so far recorded from Persia except perhaps *anceps*, of which the early stages are still unknown; it is probably extremely local because of its close attachment to a foodplant of a very specialised habitat.

Male: Fore-wing :—whitish buff, heavily dusted with brown, especially along the cell, where the reniform and orbicular stigmata are left paler. 1st line, zigzag, dark brown with a whitish inner edge. Central shade, running from costa between stigmata, to inner margin, diffuse, regularly curved, visible throughout its length; outer line, curving inwards between the nervures, dark brown with whitish outer edging. Costa, dark grey except for whitish marks, which continue across the wing as the paler edging of the lines already described and for whitish dots marking the termination of nervures 10, 11 and 12. Hindwing :—sooty brown; the nervures darker; darker grey towards the termen. Span :—41 mm.

Holo-*Type* :—♂, hatched 8-2-42 from larvae found in March and April, 1941, in Tang-Ab gorge, near Firuzabad, Fars. (4000 ft.). In coll.m.

The larva is dirty green, infused dorsally with bluish grey. Dorsal line, yellowish white, interrupted at the somital joints. Subdorsal lines, faint, whitish green. Spiracles, yellow, black-rimmed, placed just above a yellowish white line interrupted in the somital joints. Setae, black. Dorsal markings, rudimentary, consisting only of two very faint black commas and four dots on each somite, arranged transversely to the central line. Head, dirty yellow brown, with black specks.

Foodplant, a species of *Scrophularia* with round fleshy dentate leaves and brittle stems, growing only on vertical cliff faces in gorges at 3000-4000 ft. in Fars, a zone intermediate between the true desert zone (with date-palms) and the high mountains and steppes. The larva hides by day in the clumps of this plant and can be shaken or beaten out into a tray. It feeds at night on the flowers and leaves.

Like other nocturnal feeders of the group, this larva's markings are rudimentary and not conspicuous like those of the diurnal feeders of the group which rest by day on the flowers and whose bright colouring is thought to be 'warning-colouring' denoting distastefulness.

Strigicosta, one of its nearest dwelling relatives, is a conspicuously marked day-feeding larva, to be found on a different species of *Scrophularia,* which grows on the tops of low desert hills, at 500-1000 ft., between the Mesopotamian desert and the Zagros range. Its back is marked with a series of heavy black crosses (my fuller description of this larva was given by Boursin in his original description of *strigicosta*, 'Beitrage zur Kenntnis der Agrotidae-Trifinae, XXIII, (Mitt. Muench. Ent. Ges. XXX Jahrg. 1940, Heft II).

Heterobapta plumellata n. gen & n. sp.

This genus (type :—*plumellata* mea) differs from *Bapta* Steph. (*Aleucis* Curt.) in the pectination of the male antenna. The type cannot be regarded as a *Thera* or as an aberrant *Erannis* because its female is fully winged. It cannot, either, be put into Wehrli's genus *Epitherina*, according to Prout, who has examined a male *plumellata,* because Wehrli describes that genus as having a well-developed tongue and 'vein SC'long anastomizing with cell', apart from a probable difference in frontal prominences and male antennae. *Megametopon* Alph., another neighbouring genus, is too little known to attribute this new species to it. The erection therefore of a new genus for the present specis is, according to Prout, 'forgivable'.

In facies, *plumellata* closely resembles *Bapta* (*Aleucis*) *distincta* H.S. (*pictaria* Curt.) ssp : *orientalis* Stgr. (perhaps a distinct species from *distinctata*), but *orientalis* and *distinctata* fly in spring and the males have simple antennae; *plumellata* is autumnal. The enlarged photo in the plate gives so good an idea of this species that a further detailed description is unnecessary here; the ochreous forewing is heavily speckled with black and marked by a clear black elongated cell-spot which is parallel with the outer margin; the teeth of the irregularly running postmedian line are also defined clearly in black in most examples. Antenna :—bipectinated in the male, simple in the female. Otherwise, the sexes closely resemble each other.

Span :—27-28 mm.

Holo-*Type* : ♂, Pir-i-Zan woods, (c. 7,000 ft.) 20-10-40. Fars.

Allo-*Type* : ♀, ditto. Both, in coll. mea.

Para-*Types* : ♂♂ ♀♀♀, Sineh Safid, (C. 6,500 ft.), 27-10-40, Fars.

One of these para-types has been seen by Mr. Prout; all are in my collection.

The early stages are not known to me.

(?) **Erannis bahmana** sp. n.

I should not be surprised if the female of this species proved to be fully winged, and in that case the species would have to be attributed to *Heterobapta* or *Epitherina* (see above), or a new genus and not to *Erannis.*

Bahmana can be distinguished from *plumellata* by its being vernal, and also, in facies, by the weaker definition of its cell-spot and other markings and its straighter-running post-median line. It flies at the same time as *rhodopoleos* but differs from it in foodplant :—I described the early stages of *rhodopoleos* in 'Early Stages of Oriental Palearctic Lepidoptera' (*Journ. Bombay Nat. Hist. Soc.*, April, 1943); its foodplants are *Prunus* and *Amygdalus*; *bahmana* is about the same size and shape as *rhodopoleos* but can be distinguished by the starting of the straighter running postmedian line nearer the apex of the forewing.

Male :—antenna, penicillate. Fore-wing, dirty brownish-white densely speckled with black, thus appearing grey. First line, indicated by slight grey shades on the costa and inner margin only. Postmedian line, dentate, with a blackish outward point on each nervure, clearest near the apex, where it has a whitish outer edge, and running fairly straight across the fore-wing. Discal spot (cell-spot), faint. Termen, black, whitish edged. Fringes, grey, paler *basad.* Hindwing, paler grey, with one rather straight dentate line, most clear near the anal margin. Termen, black, interrupted. Fringes, brownish grey. Underside :—both wings, paler, with discal spots faint but traceable; forewing, postmedian-line clearly marked in black on costa near apex, where it starts at right-angles to the costa, then curves parallel to the margin and disappears; hindwing, postmedian line, dentate, traceable throughout. Termen, interrupted. Span, 27 mm.

A non-descript, weakly-marked little moth.

Holo-*Type* :—♂, hatched on 2-2-42 from a larva found at 6,000 ft. on Muk Pass (Gir-i-Bahman), Fars, (south of Shiraz), in coll. m.

Larva :—slender, grey, with small head; dorsal, subdorsal, and lateral lines, broad, darker grey, with darker edges. Dots black. A dorsal series of dark grey × marks. Spiracles, white, grey-rimmed, inconspicuous, placed above a whitish line edged below with a heavy black interrupted line. Underside, grey-dappled and less strikingly lined and marked, but with a pale sublateral and ventral line. Head, small, rather flattened, grey, dotted with black. (Figure 12).

Foodplant, the wild pistacia trees of the Fars steppe-woods (*Pistacia* (?) *khinjuk*); on the leaves.

The larva is full-grown in May; the moth emerges the following February, and probably also in March and April at high altitudes.

Several larvae of this species were extracted from the bill of an immature *Dryobates syriacus,* which nests in the wild pistacia trees; proof, if any were needed, that this Pied Woodpecker feeds not only on what it may find in the bark but on what it finds on the foliage of the trees.

Epitherina pistaciae sp.n.

Until a male be forthcoming, one cannot be sure to what genus to attribute this striking species. It agrees with *rhodopoleos* Werhli in season, in general shape of wings and in the female's being full-winged, but differs in foodplant and facies. The bold markings recall a *Boarmia* and at once distinguish it from the other Fars spring or autumn moths, *rhodopoleos, plumellata,* and *bahmana,* which resemble each other to some extent superficially. Its larval structure as well as that of the imago's thorax, etc., rule out the possibility of its really being a *Boarmia.*

Female :—antenna, simple. Forewing, pale buff, freckled with grey in median field. Basal line, heavy, black, with two sharp angles, one on the cell, the other actually touching the antemedian line, near the inner margin. Antemedian line, heavy, black, zigzag, but less extremely angled, and with its angles not conforming with those of the basal line. Postmedian line, curving basad between the nervures, which each here bear a fine white dot on the tooth edge of this line. Submarginal area, heavily shaded with grey, but the white dentate submarginal line running from apex to inner margin is distinctly traceable and is placed just posteriorly to a straighter dark shade. Termen :—a disconnected series of black circumflex marks. Fringes, grey, with a white middle line parallel to termen, but blacker basad. Hindwing, pale buff, heavily freckled with grey, more so towards anal margin. First line, darker grey, vaguely defined; second line, dark grey, curving basad between the nervures, and edged outwardly with whitish. Submarginal line, as on forewing, if rather more interrupted. Termen, as on forewing, but less interrupted. Fringes, as on forewing. Discal spot, weakly indicated. Underside :—whitish buff, freckled with grey, especially in submarginal area near forewing apex; discal spots visible on both wings, less clearly marked on hindwing. Span : 27 mm.

Holo-*Type* :—♀, hatched on 28-2-42, from a larva found in May at 6,000 ft. on the Muk Pass, south of Shiraz, Fars.

Larva :—slender, with small head; green, finely and faintly lined with yellow. Somital joints, yellow. There is a distincter white sublateral line just below the inconspicuous yellow spiracles. The lips of the anal orifice have a fine white edge. Head, small, rather flattened, glossy, pale green.

Foodplant, wild pistacia on the leaves. Full-grown in May.

THE PLATE.

Besides the above four new species, the plate also shows:—Fig. 1. A pale example of *E. rhodopoleos.* This species varies considerably, and melanic examples occur occasionally (I took one at Shapur Gorge on 28-2-41 (3,000 ft.) The commonest form was illustrated by Brandt in his article which appeared in the *Ent. Rundschau* 1938-9; Wehrli's original description appeared in the same periodical, in 1938, No. 31 (p. 354).

Fig. 3 is of a species which flies together with *H. plumellata* but cannot be confused with any other Fars 'winter moth'; its provisional determination is a South Zagros race, probably not named yet, of *Erannis bajaria* Schiff. The female is wingless, and I have bred several examples of this form. In captivity its emergence extends from November into January.

Fig. 9 is of the only known specimen of *Hemerophila* (*Megalycinia*) *engys* Wehrli, of which this rather poor photo was taken by me before transmitting it to Switzerland, where it still reposes. Being a Zagros autumnal moth, though from the North Zagros, it may be useful to readers to have an illustration of it in this article. The original description appeared in *Mitt. Munch. Ent. Ges.* xxix *Jahrg.* 1939. *Heft.* 1.

Fig. 10. *Eogenes alcides* ssp: *elama* mea; a preliminary description appeared in *Journ. Bombay Nat. Hist. Soc., December* 1941; at the time of writing (October 1942) I believe the longer description has not yet been published.

THE PAPAYA, ITS BOTANY, CULTURE AND USES.

BY

L. S. S. KUMAR AND A. ABRAHAM.

(*College of Agriculture, Poona.*)

(*With four plates*).

Carica papaya, commonly known as the Papaya, is a native of tropical America, where nearly all the other forty and odd species of the genus *Carica* are to be found. With increase of facilities in navigation, the species spread to nearly all parts of the tropical world and is now a well established fruit tree of importance in most places where it can be successfully grown. It is believed on good authority (vide story, 1941) that the papaya first came to India from Malacca as early as the sixteenth century. At present it is found in cultivation in all tropical countries and extends into some sub-tropical areas also in America. Frost completely destroys the plant; and so it cannot be grown in areas subject to extreme cold during any part of the year. As an easily cultivated plant with a very profitable and continuous yield of tasty fruits, having health-giving properties, the papaya deserves wider recognition in India.

GENERAL DESCRIPTION.

The botanical relationship of the genus *Carica* has been rather doubtful and it has variously been classified with the families Passifloraceae, Cucurbitaceae, Bixaceae and Papayaceae, though now it is placed under Caricaceae. The papaya is a large, almost herbaceous, dicotyledonous plant consisting usually of a rather fleshy, though firm, erect stem surmounted with a crown of large leaves. The stem and the leaf stalk are hollow. The plant does not normally branch unless the main bud is damaged, in which case a few branches arise, one each from the axil of any of the lower leaves. The flowers are borne in modified cymose inflorescences in the axils of leaves. One of the most interesting and at the same time puzzling features of the plant is the production of a variety of sex types possessing various flower types.

CYTOLOGY OF CARICA.

Chromosome studies on papaya as well as related species of *Carica* (vide Kumar and Abraham, 1942a) have shown that all the investigated species have a chromosome number of $n=9$ and $2n=18$ and the morphology of the chromosomes also suggest close relationship between different species. Studies in progress in our laboratory on the cytology of the different sex types of papaya[1] have shown no differences in the morphology or behaviour during cell division of their chromosomes.

FLOWERS.

The flower types vary from the male, with a pistillode and ten functional stamens attached to the tubular corolla, to the female flower with free petals, functional ovary and no stamens. Various intergrades appear between these, the hermaphrodite flower with functional pistil and stamens coming mid-way between the two extreme sex types. The functional flowers have a structure

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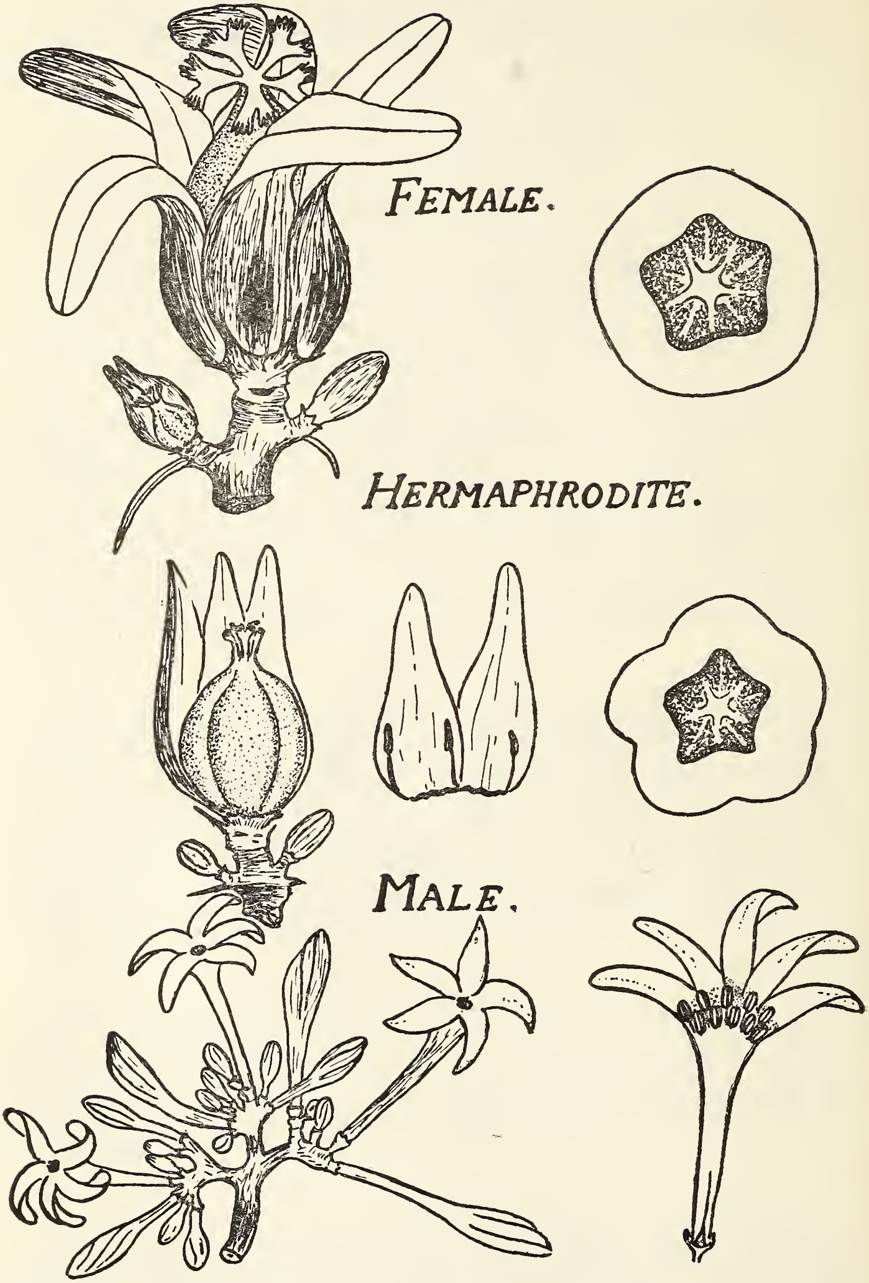
[1] Scheme of research financed by the Imperial Council of Agricultural Research, New Delhi.



Kumar and Abraham—Papaya.

Drawing showing female, hermaphrodite and male flowers. Note the difference in cross section between the female and the hermaphrodite. In the latter flower there are five stamens while in the male there are ten.

well adapted for pollination both by wind and by insects. Flowers, and consequently fruits, develop progressively from one foot above ground level to the apex of the stem. This guarantees a continuous supply of fresh fruits (except in regions subject to great seasonal fluctuations).

SEX TYPES AND FLOWER TYPES.

Papaya is erroneously considered as a dioecious plant. Actually it is polygamous and there are three main sex types: (i) pistillate or female, (ii) hermaphrodite or bisexual, and (iii) staminate or male. True monoecious types are also not lacking, as occasionally we find male plants having a few female or bisexual flowers at the ends of inflorescences. Higgins and Holt (1914) described thirteen sex forms in the papaya. But genetical studies and extensive observations on the flowering characteristics of a large number of plants in Hawaii have shown that there are only four distinct heritable sex forms, one pistillate, one staminate and two hermaphrodites (Storey, 1941). Seasonal effects may cause minor changes in these basic types, and casual observations on such forms have apparently led to the recognition of a large number of sex forms.

PISTILLATE OR FEMALE TREE.

This tree bears only female flowers having functional pistils (see photo, Pl. III). Occasionally late in the season or due to unfavourable conditions it produces pistillate flowers which drop off. The fruits are spherical and oblong in shape and usually borne singly in the axils of leaves.

HERMAPHRODITE I.

This is a type which continuously produces functional flowers, having both pistil and stamens. Slight variations in the type of flower, however, occurs due to seasonal change. This variation takes the form of irregularities in the ovary, with varying distortions of the carpels as a result of which distorted fruits are formed. Some of the lateral flowers are non-functional.

HERMAPHRODITE II.

This is similar to the above in flower morphology, but the plants are summer-sterile. The flowers produced during the summer do not have functional pistils and the male element is better developed. As a result of this variation the stem has alternating lengths of fruit-bearing and barren regions.

STAMINATE OR MALE PLANT.

The male plant is easily recognised by the long pendulous inflorescences borne on it and the small flowers with narrow tubular corollas (Plate III). Occasionally a male plant may bear a few bisexual or female flowers, at or near the terminal portion of the inflorescences and these may give rise to a few fruits (Plate V).

GENETICS OF SEX IN PAPAYA.

Independent investigations carried on at Hawaii by Dr. W. B. Storey, and at Nelspruit, South Africa, by Dr. J. D. J. Hofmeyr have thrown interesting light on the genetics of sex in papaya. Sex determination has been shown to be based on simple Mendelian factors. The male and the hermaphrodite are heterozygous for sex, while the female is homozygous, having 2 doses of *m*, the recessive factor for femaleness.

Crosses between female and male give progeny which shows an equal proportion of female and male. Crosses between female and hermaphrodite give a progeny with an equal proportion of female and hermaphrodite. Hermaphrodites selfed gives a proportion of 1 : 2 of female and hermaphrodite. The occasional flower with functional pistil enables selfing of the 'male' and this gives a 1 :2 ratio of female and males. Hermaphrodites crossed with male gives progeny showing equal proportion of females, hermaphrodites and males.

From the above summary of the results of genetical studies we see that the usual condition in nature is pollination of female by males, as the progeny from open pollinated flowers in plantation with a large number of males gives a 1 : 1 ratio of female to male. From a commercial point, the best cross is female x hermaphrodite, which gives rise to plants which are all fruit yielding. Because the hermaphrodite is always heterozygous, no race pure-breeding for sex could be obtained. The best that could be achieved is to eliminate males by using pollen from hermaphrodite to pollinate female flowers. For such artificial pollination, the female flowers should be covered with butter paper bags in the bud stage and the day the flower opens the stigma should be dusted with anthers removed from hermaphrodite flowers (also bagged in bud stage to avoid contamination with foreign pollen). Anthers should be taken from flowers just prior to opening, as the pollen is shed at that stage. A single hand-pollinated fruit of good size may give nearly thousand seeds and as all the viable seeds would give rise to fruit yielding plants, the trouble taken to ensure controlled pollination is really worthwhile. But if the demand for seeds is very large and production of reliable seeds has to be made on a commercial scale the method suggested below might be followed by commercial nurseries. Grow a small area, say about an acre, of papayas at a safe distance of at least half a mile from any other papaya plant. Use the best available seed for the nursery and plant three or four seedlings, one foot apart, in each pit. As soon as flowering commences remove all the males and retain as many females and hermaphrodites as possible, keeping only one plant per pit. After the final weeding of the male plants are over, remove the few young fruits on the trees retained, as these might have received pollen from some male pants. The fruits developing after this on the female plants may be collected for seeds, while the fruits on the hermaphrodites may be sold off. In choosing the fruits for seeds note the following further points :—The plant must be vigorous and a good yielder; the fruit must be of a large size with good shape and ripening into an attractive colour; the flesh must be thick and deep yellow when ripe, and the taste of the fruit must be the best in the variety. The crop produced from this first selection will necessarily be variable though approximately equal numbers of females and bisexuals may be obtained from the seeds collected in this manner, if no contamination from stray males has taken place. From the second plantation onwards it is not necessary to plant more than two seedlings per pit, as the chances of male plants appearing decrease with each successive selection. If this method of selection is persisted in, male plants could be eliminated and a fairly uniform crop with desirable qualities could be obtained. However, it must be stressed that for success in this method there should be no male papaya plants in the near vicinity of the plantation as otherwise wind or insect pollination might lead to some contamination. *The only sure method is bagging the flowers and pollinating artificially as described earlier.* Another point to be remembered is that while for seed purposes the best cross is female x hermaphrodite, in open-pollinated conditions presence of a few male plants guarantees larger quantities of pollen, which is necessary for good seed setting, which appears to have some favourable effect on the development of the fruit. So in large plantations it is best to allow a few male plants also, as this would ensure better fruit production. Seedlings for these males can be separately raised from seeds obtained from the occasional fruits of a male plant. These would normally give rise to more than sixty per cent. of male plants and a few of such seedlings can be added on later to the plantation raised from seeds obtained by controlled pollination.

FRUITS.

Papaya fruits are extremely variable in size, shape, colour, flavour, etc., and even in the same variety there is no uniformity regarding all these characters. Generally it is spherical to oblong in shape and is made up of five carpels fused together by their margins to form a hollow cavity inside which a large number of seeds with parietal placentation are found. In all the varieties except the Travancore papaya[1] (Kumar and Abraham, 1942b)

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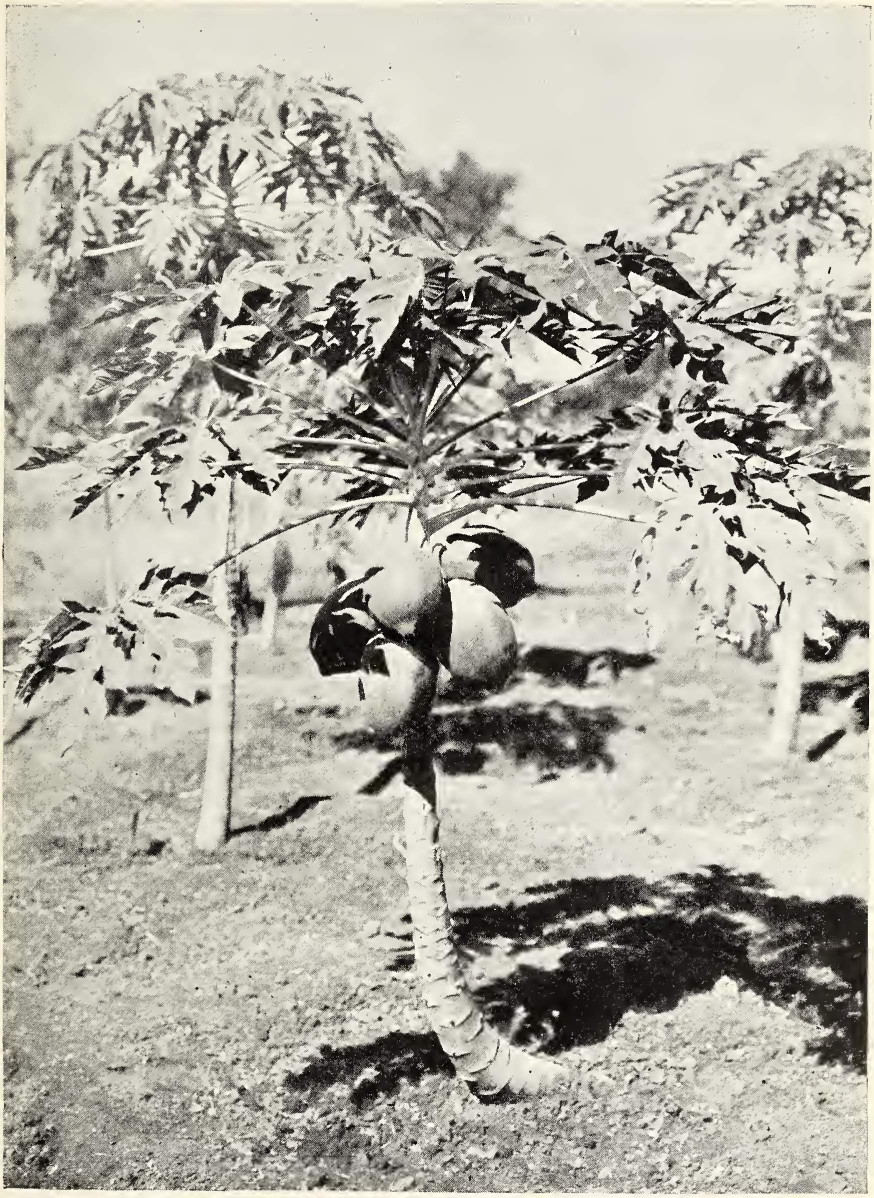
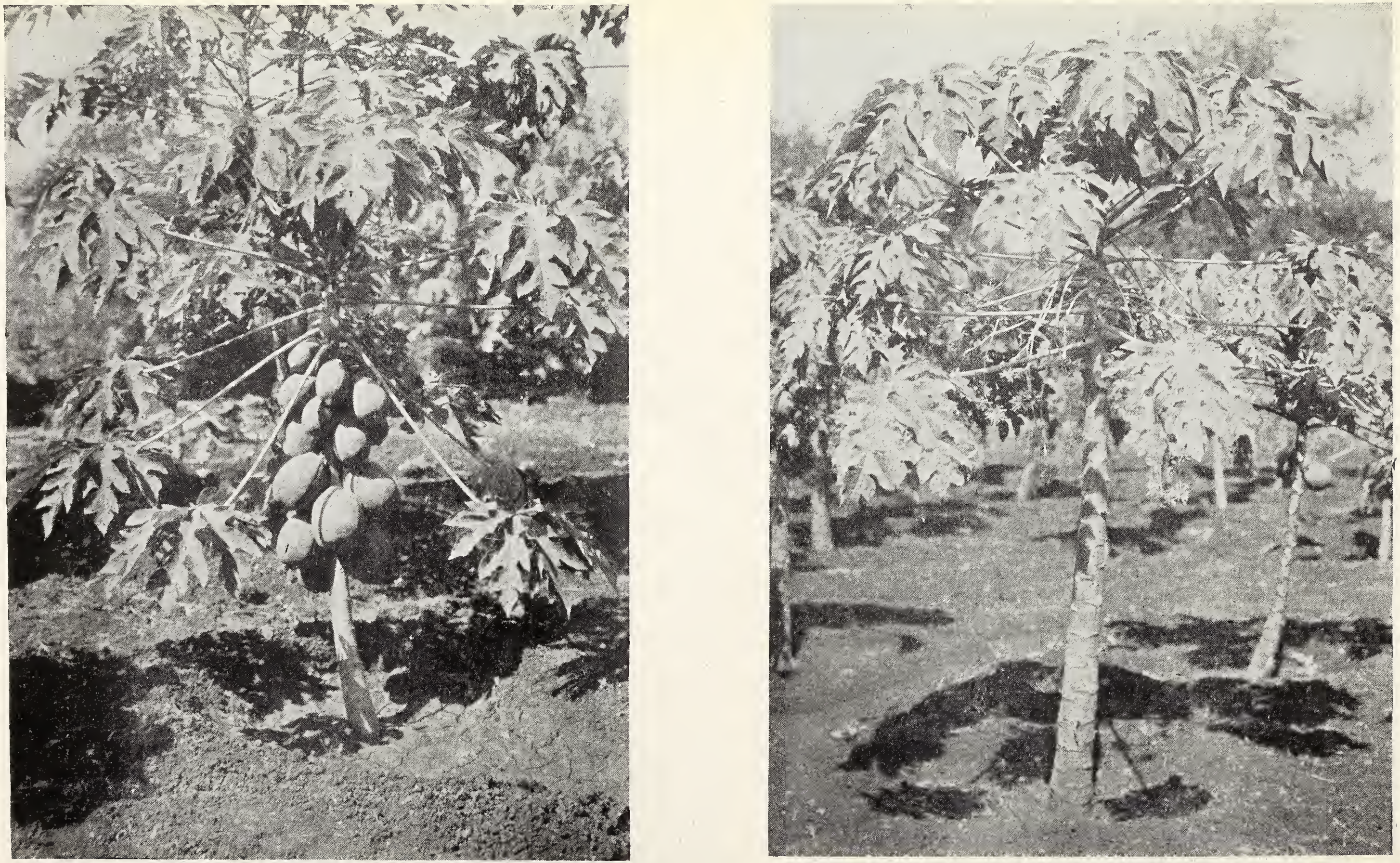
[1] In the Travancore papaya the whole plant is yellow and the flowers and fruits are markedly yellow. The leaves are yellowish green and the fruit on ripening changes to a reddish yellow and has an agreeable flavour.



Kumar and Abraham—Papaya.

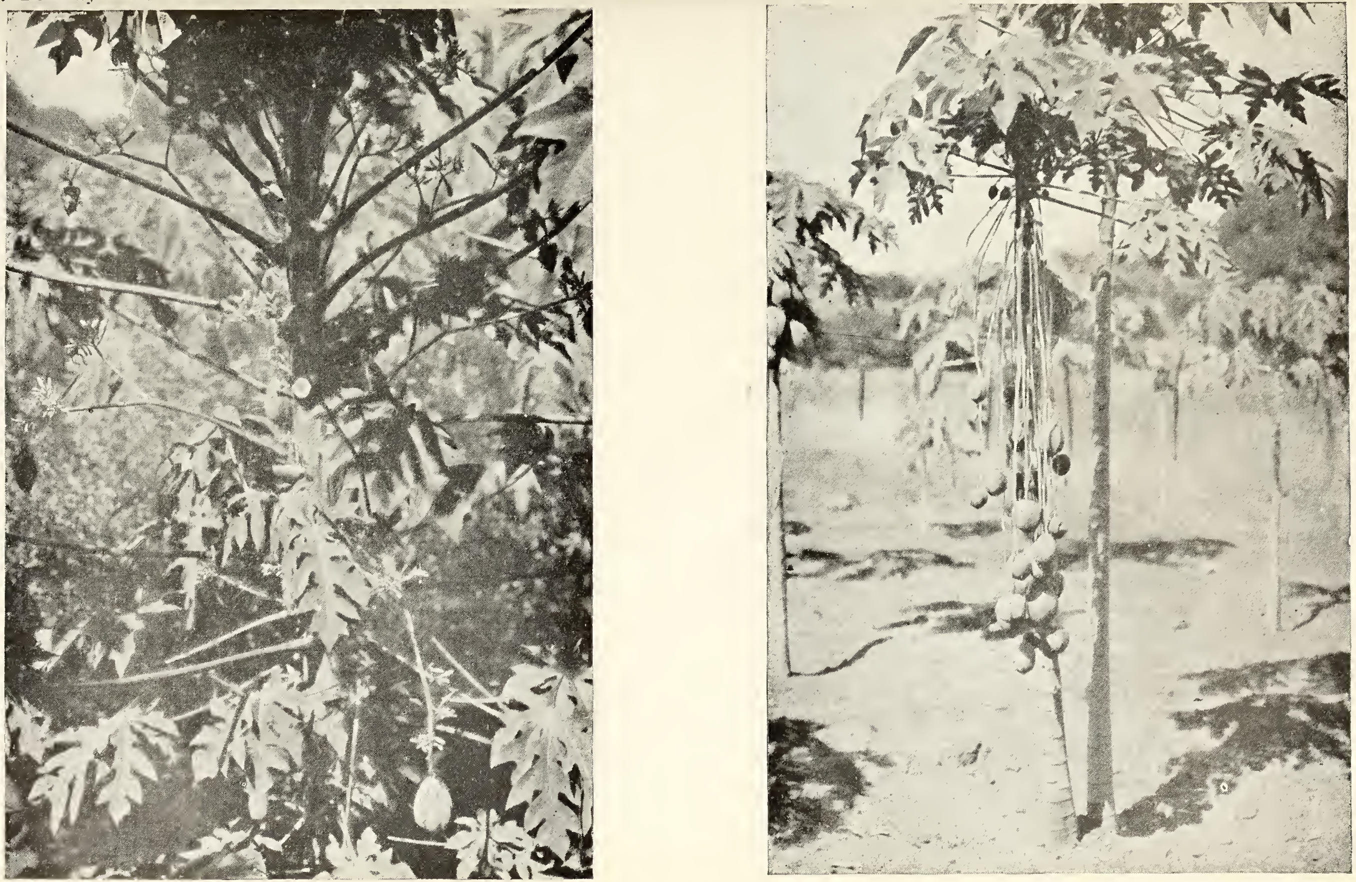
A female papaya plant nearly one year old. Due to poor soil fertility and effect of seasonal variation the upper part is without fruit.



Kumar and Abraham—Papaya.

Left. Female plant.—Ten months old, growing in good soil and bearing fruits right up to the apex, and from less than two feet from the ground.

Right. A male plant also of the same age. Note the long pendulous inflorescences bearing numerous small flowers.



Kumar and Abraham—Papaya.

Left. A male plant bearing a few female flowers and fruits at the terminal portion of inflorescences predominantly bearing male flowers.

Right. A plant with inflorescences exactly similar to the male inflorescence in appearance, but with all flowers female. The flowers are only as large as the male flowers but the terminal flower is much larger and usually functional.

the skin of the fruit is green when immature and it turns to a fine yellow colour with varying tinges of orange or crimson. The colour of the ripe fruit depends on the climate also. Thus, it is noted that while the climate of Travancore is quite suitable for a luxuriant growth of the papaya plant, the fruits when they ripen have a pale green colour with only a tinge of yellow at the bottom. In a colder and slightly drier climate like Poona the fruits usually assume an attractive yellow colour on ripening. Similar observations on the effect of climatic conditions on the colour of the fruit have been made by Hofmeyr (1939). The taste of the fruit is independent of the external colour of the skin and it has been also noted that the colour may be improved by selection. But the market value of fruits depend to a great extent on its colour.

Culture of the Papaya.

Any well drained soil is suitable for papaya cultivation, though it comes to its best when grown in deep rich soil. Under the best conditions of soil, moisture, light, and heat the plants mature at an early age and produce an abundance of fruits from as low as one foot from the ground. In shaded places or under less favourable climatic or soil conditions the plants show a tendency to be slender and the bearing is very poor.

Propagation is entirely done by seeds. Seeds are sown in well prepared seed beds. The best time to sow the seed is from June to August. Sow the seeds in rows nine to twelve inches apart and allow one to two inches between seeds. Then cover the seeds lightly with a mixture of soil and river-sand. Water immediately after sowing and once a day till the seeds germinate, after which less frequent watering will suffice. Seeds germinate within a fortnight. Thin out the seedlings so as to allow 4 to 5 inches between plants. Within two months the seedlings reach a height of 6 to 8 inches and are ready for transplanting. The planting pits should be spaced 8 to 10 feet in either direction (which allows about 500 plants per acre) and should be 2 feet deep and 2 feet on the sides. Fill the pits with a mixture of soil and farm-yard manure in equal proportion and 2 lbs. bone meal per pit. Transplanting should be done carefully and the seedlings shaded till they establish properly. Put 3 to 4 seedlings, one foot apart, in each pit. If seeds used are from controlled pollination (female × hermaphrodite) one or two seedlings per pit will do. Within four to six months plants begin to flower, usually the males coming to flower earlier. As soon as the earliest detectable male inflorescence is seen on a plant, cut it off and dig it out without damaging the roots of the neighbouring plants. A dozen male plants per acre is sufficient for normal pollination, though if a good number of hermaphrodites are present, male plants are not necessary (see earlier part). Retain only one plant per pit. During the rainy season care must be taken to see that the water is well drained off; otherwise whole plantations might be lost due to rotting of the roots. About two months after transplanting a top-dressing of some easily available nitrogenous fertilizer such as sodium nitrate or ammonium sulphate should be given and its application repeated after another three months. If this is not possible a top dressing of good farm-yard manure may be given every three months.

Uses of the Papaya.

Papaya is mostly consumed as ripe fruit, either for breakfast or as dessert. It is a highly nutritious food and is an economic source of vitamins A and C and of calcium besides possessing smaller quantities of vitamins B and D. In Hawaii, the country where papaya is extensively cultivated, in addition to consumption of fresh fruits, some are canned as papaya juice, and quite a good quantity used for preparation of jam, marmalade, pickle, cocktail, etc. In Western and Upper India it is usually consumed as ripe fruit, though its use as a vegetable is well known. In the Bombay market a large-sized ripe fruit may fetch up to one rupee. In Southern India there is some prejudice against the fruit, and it is very rarely cultivated; though in the backyards a stray plant or two may be occasionally met with. In Travancore also people have not taken to papaya cultivation though the fruit is generally liked. There it is more used as a vegetable, for which raw green fruits are picked. It is cooked in a variety of ways, the commonest of which is to remove the skin and seeds and chop the fruit into very small bits and then boil it, later adding grated cocoanut, salt and some light spices. It is well known that tough meat may be rendered tender by cooking it with green papaya fruits. This must be due to the protein-splitting activity of papain.

PAPAIN.

All the parts of the papaya plant, except the roots, contain a thin milky latex which flows freely when any part is wounded, but on exposure coagulates and hardens into a white mass. This latex contains a high percentage of papain, which is one of the most valuable of plant proteolytic enzymes. Commercial papain is prepared by drying the latex collected by tapping the green fruits. The method of collection of latex is very simple. Large, nearly mature green fruits are selected, and three or four shallow, lengthwise incisions are made on each fruit with a non-metallic knife. Latex flows rapidly and profusely at first, but coagulation soon checks further flow. The coagulated latex is carefully scraped off and then dried in the sun. As soon as the latex is dried and ground into a powder, it should be enclosed in air-tight containers, as exposure to air inactivates the enzyme. Unfortunately, in India no attempts have been yet made to produce papain on a commercial scale, though immense possibilities lie in that direction. In 1938, the United States alone imported nearly 230,000 pounds of papain. Other foreign markets too are available for papain. The fruits from which papain has been collected are too much scarred to be of use for marketing, though the taste is not affected. But it could be used for making jams, jellies, etc. Thus, the collection of papain could be made more profitable if side by side manufacture of other by-products like canned juice and pulp, marmalade, jam, etc., could be developed. This is a commercial possibility which needs careful exploring.

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A FEW NOTES ABOUT THE FIVE RHINOCEROS OF THE WORLD.

BY

W. S. THOM.

In this article I propose giving a brief account of how many years ago I came upon and shot in Burma my best double-horned rhinoceros, the species known as *Dicerorhinus sumatrensis*. Before doing so, however, I trust I may be pardoned for first recording somewhat in detail, not only something interesting about this rare animal, but also a few facts about the other four remaining species of rhinoceros, all of which are as a matter of fact rapidly heading for extinction.

There are in the world only five species of rhinoceros in existence at the present time, namely the two species in Africa, both of which are double-horned, that is to say, the black rhinoceros, *R. bicornis*, and the so-called white animal *R. simus*. Both of these animals are, as a matter of fact, of a dark grey colour and stand about six feet in height at the shoulder. Then there are two species that are said to exist in Burma, namely the Lesser one-horned rhinoceros, *R. sondaicus*, which stands about five feet at the shoulder or a little higher and is now probably extinct in Burma and *Dicĕrorhinus sumatrensis*, the Sumatran double-horned rhinoceros, the smallest and the most hairy of all rhinoceroses, which seldom exceeds a height of more than about four feet six to eight inches. Finally there is the Great Indian one-horned rhinoceros, *Rhinoceros unicornis*, or *Rhinoceros indicus* as it is sometimes called. *Rhinoceros sondaicus*, the Lesser one-horned animal which must, I suppose, be considered to be the rarest of all the rhinoceroses was once found in Bengal, Assam, Burma, Malaya, Siam, Borneo, Sumatra and Java, but there are now probably only about twenty left in Java, and four or five in a remote corner of Malaya.

I have never seen this animal *R. sondaicus* the Lesser one-horned rhinoceros anywhere in Burma, although I have travelled and shot over almost the whole of this country, nor have I even come across any traces of it or even met anyone who had shot or even seen one. Some years ago it was said by the officers of the Burma Forest Service to exist in the Kahilu Forest reserve in the Thaton District of Burma.[1] I disputed this at the time and am still inclined to think, with all due deference to the views of all of the Forest officers concerned, that they are wrong and that the only rhinoceros in existence there or anywhere else in Burma is the double-horned species, namely *Dicerorhinus sumatrensis* and that as stated above *R. sondaicus* is extinct so far as Burma is concerned. I have not the least doubt that this animal, *R. sondaicus*, probably existed in this country for a considerable period in bygone years but that it has since become extinct.

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[1] The skull of a Lesser One-horned Rhinoceros (*R. sondaicus*) secured from a decomposing carcase found in this area was sent to us by the Forest Department and is now in the collection of the Society.—Eds.

C. B. C. writing in the *Illustrated Weekly of India* of March 1939 stated that *Dicerorhinus sumatrensis,* the double-horned rhinoceros, once had the same habitat as *R. sondaicus,* the Lesser one-horned rhinoceros, except that it was not found in Java; now however, according to C. B. C. *D. sumatrensis* survives only in Malaya and Borneo where perhaps some fifty animals still remain, but I can state on very good authority that this statement of C. B. C's is incorrect as this animal survives also in Burma where I have shot several of them during the past fifty years, and where there must be at least forty or fifty more of them still in existence. In fact I am of the opinion that there were always more of the double-horned species of rhinoceros in Burma than there ever were of the single-horned animal, namely *R. sondaicus.* Probably the reason for this is that *D. sumatrensis* have always been more difficult to get at, being essentially hill climbers invariably found only in very inaccessible places in the hills, and therefore more difficult for hunters to get at; whilst *R. sondaicus* invariably inhabit the plains and flat country, where naturally enough they are more easily followed and shot than if they had been inhabitants of the hills 'like *D. sumatrensis.* The latter, namely the double-horned rhinoceros, is also a much more active, sturdier, and more cunning animal than is *R. sondaicus*, but it is also one of the most harmless wild animals in existence. I consider also that of all the difficult and exasperating animals to follow through dense jungle *D. sumatrensis* easily takes first place.

C. B. C. states also in his article that *Rhinoceros unicornis*, or *R. indicus* as it is sometimes called, the great Indian one-horned rhinoceros, was never found outside India, Burma and the Nepal foothills, and that at the present moment less than two hundred of these animals still survive in Northern Bengal, Assam and Burma'. I personally have never heard of this animal's existence anywhere in Burma and I do not believe that it ever existed in this country. In fact I have never met anyone who had ever shot an *R. unicornis,* or even heard of one being shot in Burma.

With regard to the two African species, C. B. C. says in his article that the black rhinoceros *R. bicornis* is still fairly numerous. It is the only species still found in anything like decent numbers but even it has already died out in certain tracts which knew it in thousands a few decades ago. C. B. C. also states that the white rhinoceros, *R. simus,* is so called from its habit of wallowing in the white mud of African river beds. It is much better tempered than the black rhinoceros, feeds on grass instead of shrubs and lives on open plains. It curls up its tail on the rare occasions when it charges and the more frequent ones when it runs away.' Its timidity has made it an easy prey to human cupidity.

In 1936 Sir A. Smith saw nearly two hundred of this white rhinoceros on a single day's march in the Transvaal. Several decades later it was still so common that men like Cotton-Oswell and Gordon-Cumming—two of the greatest pioneers of African sport in which category perhaps Selous and Sir Samuel Baker might also be included—got tired of shooting it. There are now, however, only about a hundred survivors in Uganda, some forty in Zululand, and a few in the Belgian Congo and the Sudan. They do not breed until twenty-five years old, and then produce singletons at intervals of six or seven years. These remarks regarding the breeding period of the white rhinoceros apply almost equally to *Dicerorhinus sumatrensis*, the double-horned rhinoceros, except that I would say that twenty years is probably nearer the period when these two animals begin to breed, instead of twenty-five years, whilst seven months is about the period of gestation, so far as *D. sumatrensis* is concerned. I have no doubt the same obtains in the case of *R. sondaicus*, the Lesser one-horned rhinoceros, as well as to its relative the Great one-horned Indian rhinoceros, *R. unicornis*, or *R. indicus*, so far as the periods of breeding and gestation are concerned.

It is not generally known by the way that both *R. unicornis* and *R. sondaicus* have so called 'foot glands' embedded in the integument of the foot. In *Dicerorhinus sumatrensis* the double-horned animal, however, these glands are absent.

In Africa as in Asia, horn smugglers were responsible for much illicit rhinoceros destruction. These smugglers used to operate from the coast buying surreptitiously from those who kill the beasts, and then ship the horns away in Arab dhows. The traffic is very difficult to suppress but occasionally a record haul is made. Only a few years ago for example, five men were detected in an attempt to smuggle one-hundred and eighty-seven out of Kenya in one boat.

The Chinese prize the blood as well as the horn of the Burmese, the Malayan, and the Javanese species wherever found. As a matter of fact, in all the countries named above, there are only two species namely the *D. sumatrensis,* the double-horned animal, and *R. sondaicus,* the single-horned rhinoceros, except that as previously mentioned the last-named is extinct in Burma, so far as I have been able to ascertain. The Chinese use the blood and horns of the animal for medicinal purposes as well as for an aphrodisiac, whilst the horns are sometimes carved into ornaments. Strips of the hide of the African species are also converted into whips. All rhinoceros horns are of the same texture, being simply agglutinated hair which, if cut in a thin transverse section and placed beneath a microscope exhibit the capillary tubes glued together into a solid body by a horny substance. There is no material that can equal in toughness the horn of rhinoceros, and it has always been in request from time immemorial for various useful and other more imaginary purposes. The skin of the rhinoceros is exceedingly compact and dense. When stretched over a block of wood and dried and then rubbed down with sand paper and oiled, it becomes semi-transparent like clouded amber, and is also much esteemed when a square of it is mounted as a top for a tea table. The belief that a cup formed of rhinoceros horn will detect poison is both ancient and common and is thoroughly accepted by the Arabs of the Soudan.

The horns of the rhinoceros are not attached to the skull, but are merely seated upon the hard thick bone which forms a foundation slightly convex, above the nose. The skin is immensely thick at the base of the horns and it appears bristly and rough, to a degree that would suggest gradual development into horn, which is actually the case. When a rhinoceros has been killed, and the head has been exposed in the sun to dry, the horns will fall off on the third day if struck lightly with a stick, and they exposing the foundation upon which they rested; this closely resembles the bottom of an artichoke when the prickly leaves have been removed. Although the horns would appear unsuitable for rough work, being merely attachments to the skin they are most powerful weapons of offence.

It has been asserted that the two African species and the Indian rhinoceros, *R. unicornis*, all three of which are very bulky animals and which stand much higher than either *D. sumatrensis* or *R. sondaicus*, will kill an elephant; this is highly probable if the rhinoceros had an opportunity of striking the elephant in the stomach or the flank with its horns by an unexpected attack; but no rhinoceros would have the remotest chance in actual conflict with an ordinary full-sized bull elephant as the weight and strength of the latter would be unmeasurably superior, in addition to the length and power of the two tusks. Elephants are much afraid of rhinoceros, but they are almost equally timid with other animals. A rhinoceros, again, although a sullen stupid brute is usually afraid of nothing. I am referring of course only to four out of the five species of rhinoceros and totally exclude *D. sumatrensis* as it is quite a harmless animal. We, hunters in the nineteenth century, were not presumably aware of this until we had been hunting them for some time.

I possess two small square tea tables made from the hide of a *Dicerorhinus sumatrensis* shot by me, which were mounted in fumed English oak by Peter Spicer or Leamington, England, a well known taxidermist. The base or pedestal of each of these square rhinoceros hide tea tables is composed of a single foot of the same animal. In the case of one table the hide composing the top has been denuded of the bristles, and polished and is semi-transparent like clouded amber, whilst the top of the other table is composed of the natural hide of the animal with the stiff bristles of hair left on it. I also possess three other rhinoceros feet that have been mounted by the same taxidermist, two as rose bowls, and the third as an inkstand.

These articles like other trophies of mine are now no doubt in the hands of the Japanese with my house and all my other property including my trophies, negatives, and photographs.

In the nineteenth century nearly every sportsman in India, Africa and Burma vied more or less with his neighbour as to who should first shoot the animals with the finest trophies, the result being that in many cases more animals were shot than was perhaps necessary. I happen to have the luck to hold five records so far as Burma is concerned namely (1) tiger, *Felis tigris* (2) Sambar, *Cervus unicolor* (3) Thamin, *Cervus eldi*, the brow antlered deer of Burma (4) Goral *Cemas goral*, and (5) Leopard, *Felis pardus*. The fact that I did get these five records does not mean that I went all out to get them and that in consequence I shot more animals than I was entitled to shoot. Not at all. It is a fact that the shooting of record heads is entirely a matter of luck and nothing else. It is of no earthly use trying to tell, an experienced hunter, that it is anything more. You can boast to yourself, and to your friends that it is merely a question of perseverance, but it is nothing of the sort. I had a long conversation with the redoubtable F. C. Selous in Perth, Scotland, on the subject of big game shooting, in the year 1900, when I went home on leave for eighteen months for the first and the last time. He was by the way the original of Rider Haggard's *Allan Quatermain* and one, if not the greatest, of all African sportsmen; alas, long since gone west to the happy hunting grounds. In all the years he hunted big game in Africa and elsewhere, and amongst all the thousands of animals he must have shot, never had a single record head or record pair of elephants tusks to his name.

These exploits of course may easily be decried by the present generation of sportsmen, some of whom may not have had the luck to encounter all the thrilling experiences that have fallen to the lot of old timers such as myself for instance.

A writer in the *Burma Police Journal,* Volume III, 1940 (see bottom of page 274) writing about rhinoceros said, 'I should like to mention the extraordinary behaviour of two Sumatran rhinoceros with which I have been in contact during the past two years. In the first case a Sumatran rhinoceros walked into the middle of my camp in the Shwe-U-daung sanctuary'. (This sanctuary is situated in the Ruby Mines District of Upper Burma where I did a good deal of shooting in the eighties and nineties) 'at two o'clock in the afternoon and stopped at a range of ten feet to look at a camp follower chopping firewood. The rhinoceros showed no alarm at the sight or scent of human beings. In the second case, which concerns the rhinoceros I recently photographed in the Kahilu Forest reserve of the Thaton District, Burma, it was only after much shouting on my part, at a range of less than ten yards, that I was able to induce the rhinoceros to leave his wallow and within five minutes of driving him from the wallow he returned again and resumed his bath. Ah one stage of my attempt to obtain pictures I approached so close to the animal that I could have hit him with a long stick, and it is certain that a poacher could easily have killed the animal with a spear. 'These experiences', the writer goes on to say, 'incline one to believe, that the rhinoceros shooting exploits of nineteenth century sportsmen in this country' (namely Burma) 'were in reality stark butchery and almost devoid of any skill in tracking or approaching their quarries.'

As I was a nineteenth century sportsman whose exploits so far as the shooting of rhinoceros was concerned, could in no way be disputed, I could hardly allow that statement to pass unanswered. I accordingly wrote to the writer in question who is a forest official in Burma and asked him whether he included me as one of the nineteenth century sportsmen referred to in his article. In his reply to me he stated that he did not as a matter of fact, include me, so far as rhinoceros shooting was concerned, and that his own department (namely the forest department) was not blameless in this respect, but that he considered that Colonel F. Pollok (the joint author with me of the book, *Wild sports of Burma and Assam* which was published by Messrs. Hursh and Blackett in the year 1900 and which is now out of print) to be one of the most guilty persons; see the stories of rhinoceros shooting in the book in question which shooting was almost always done by him from the back of an elephant'. 'However, as the writer continues truly to remark in his letter to me, 'All the writing in the world will not restore the rhinoceros population especially the *Rhinoceros sondaicus,* the single-horned rhinoceros, which must be considered to be extinct in Burma.'

I am glad in a way that he concedes this point namely that *Rhinoceros sondaicus* does not exist anywhere in Burma even in the Kahilu Forest reserve, anyway that is what I presume he means. From the very beginning of the controversy as to whether there were any of these animals in the Kahilu forest reserve I had stated that I did not think that any of them existed there at all now, although I wish it were otherwise, and that I was of the opinion that the only rhinoceros in existence there now must be the double-horned species.

Colonel Pollok should not of course have shot rhinoceros in any country from the back of an elephant, although I have no doubt they were difficult to get at in Assam as well as in some parts of India and the foothills of Nepal where there are large stretches of high dense elephant grass quite twenty and even thirty feet high which cannot be penetrated unless one is mounted on the back of an elephant. In Burma of course rhinoceros did not so far as I am aware enter high elephant grass and therefore in Colonel Pollok's days, namely in the fifties and sixties, would easily have been shot by a sportsman following on foot. As a matter of fact it is as much an offence for a sportsman to shoot rhinoceros from the back of an elephant, as it would be for him to shoot an elephant in any country in the world, from the back of another elephant, the reason being that a vital spot cannot be reached as easily by a bullet fired from a howdah, or from the pad of an elephant, as would be the case if the shots were fired from the ground, where he could put in his shots much more accurately. More animals are likely to get away wounded by the sportsman firing at them from unsteady positions such as on a howdah, or on the pad of an elephant, than would be the case if he had fired at them shooting from a stationary position on the ground. I regret to say that in this way probably Pollok wounded many more rhinoceros that he never succeeded subsequently in getting. I have never shot any animals, at any time from the back of an elephant, particularly an elephant, or a rhinoceros, nor did I at any time do any shooting accompanied by Colonel Pollok anywhere in Burma, Africa, Ceylon, India or Assam.

Colonel Pollok, who crossed the 'great divide' many years ago, was a well-known sportsman and, no doubt, did a very great deal of big game shooting in the countries referred to above. He was a very keen and experienced Shikari and a very good shot, but he did all his big game shooting in the fifties and sixties when muzzle loaders even were still in use, long before I came out to

Burma. The temptation to shoot off the back of an elephant at any kind of game was naturally enough very great in those days especially as Pollok always had a large number of Government elephants at his disposal. As a matter of fact an immense amount of shooting at tiger and other large and dangerous game was done in India, Assam, and Ceylon by many well-known European and Indian sportsmen. In those days moreover there was very little written or said about the preservation of large or small game and the formation of game reserves. It is all very well to talk about these things now a days therefore and condemn or criticize the shooting exploits of old timers. There is no doubt that a great many more animals were shot in those bad old days, or shall I refer to them as the good old days, than now a days, by many well-known sportsmen shooting in every country in the world. Many of them also shot some animals from the back of elephants without realizing they were doing wrong. In the circumstances therefore a considerable amount of allowance should be made for their supposed deliquencies in this respect, if needed we can call them deliquencies.

Now with regard to Rhinoceros *Dicerohinus sumatrensis,* the double-horned species, the smallest living rhinoceros in the world and the most hairy. My shooting of these animals in Burma was done on foot in the last century by the sweat of my brow, and let it not be forgotten that I shot them before the year 1917 when they came under the protection of the law. In the nineteenth century rhinoceros were so relentlessly pursued wherever they were to be found throughout the world, for the sake of their horns and blood, that it was an extremely difficult business following and tracking up one of these animals to its lair, in Burma at any rate. They were always so very much on the alert and continually on the move, and were also usually found in the most inaccessible places in the hills, except on the very rare occasions on which they were come upon in their wallows. In a matter of fifty years of big game shooting I think I came only four times upon *D. sumatrensis,* the double-horned species of rhinoceros, in their wallows, and this after I had carried out, in nearly every case, very long and arduous treks after them. Now, since these animals have been protected by law for the past twenty-four years, is it not reasonable to suppose that they have become in consequence more tame and unsophisticated than they were before, and that incidents of the kind such as has been related in the *Police Journal* by the writer referred to, were bound to occur? Surely this is obvious? Cases have often occurred even in the nineteenth century as well as in the present century when animals have been found and shot at very close range by experienced sportsmen who have travelled miles on their tracks and who have also naturally exercised a great deal of skill in getting so near the animal before shooting it. This surely does not mean, however, that by so doing, it was 'sheer butchery and devoid of all skill in tracking and approaching on the part of the hunter.'

On another occasion in the eighties, after a very hard trek, I came upon a rhinoceros 'a *Dicerorhinus sumatrensis*' lying so deeply immersed in its mud wallow on the Shwe-U-daung range of hills in the Ruby Mines District of Upper Burma, that although I was within a few feet of its wallow I was unable to distinguish which was the head and which was the animal's hind quarters, and although I succeeded in shooting it finally, I could easily have poked it with a bamboo pole before doing so, so utterly oblivious was it of my presence and the presence of at least three of my men. It goes without saying that considerable skill in tracking and approaching so near this animal had to be exercised, and that therefore, one could hardly say, in this case either, that the animal's death constituted sheer butchery, or that it was devoid of all skill in approaching and tracking.

To revert to some other animals that I have shot at close quarters. Early one morning many years ago, in 1889 to be precise, some miles from a place called Wapyudaung a village that is situated on the Thabeitkyin Mogok road a solitary bull gaur or bison standing about twenty hands at the shoulder at which I had fired and missed at a distance of about fifty yards. I was using a double barrelled hammerless 8-bore rifle by James Tolley, the cartridges of which took a charge of ten drachms of black powder. I continued tracking this animal with my men all day after missing it in the morning, and finally came up with and shot it dead, with a right and left, at a distance of only about five yards. It was standing stock still on a hillock broadside on to me amongst some bamboo jungle, feeling as weary no doubt as were my hunters and I. However, had this bull sighted or scented me and my hunters first, the tables might easily have been turned upon us. I remember on that memorable occasion, marching all night by the light of a full moon, and it took me and my companions till six o'clock in the morning to reach camp. That will give the reader some idea as to how far my men and I followed the animal before we came up with it. It was indeed one of the longest and most arduous treks I have ever undertaken after big game. My success in bagging this fine twenty hand bull at such close quarters was entirely due to the skill and untiring perseverance of my hunters and trackers, and also in part to my own dogged determination to keep on at it till we came up with the animal once more, or until the light failed and forced us to give it up, and camp for the night. The death of this animal could also hardly be described as being sheer butchery and devoid of all skill in tracking and approaching.

A well known sportsman from Malaya made a true statement the other day when he said that as the years pass, the actual killing of large animals for sport becomes more and more distasteful even to the most ardent followers of big game and although the urge for the excitement of the chase may not be at all diminished, still the climax is no longer accepted with unmixed feelings. Besides tough and arduous treks become more and more difficult until the time comes, when ageing muscles will no longer respond to intensive effort. But one's energies can still be utilized in a mild form and one's active interest in large wild life need not become a memory. Although I do not consider for a moment that by any means it replaces big game shooting, for sheer danger and excitement, may be photography of large wild animals will fill the blank, and will provide not only a certain amount of excitement, but also should be productive of much knowledge of the habits of animals which, now that the rifle is laid aside, can be watched moving about without let or hindrance.

I do not wish to imply that wild life photography is an old man's recreation, or that it replaces the excitement obtained from big game shooting, far from it, but it is a recreation worthy of any one, and can be enjoyed after long jungle journeys are things of the past—I have heard people refer to those who have given up the rifle for photography or to hunters who now take an active interest in photography and wild life conservation as the 'penitent butchers,' an attractive catch phrase, showing the entire ignorance of those who use it. I believe that unless a man has hunted a good deal in the jungle he would find the greatest difficulty in adapting himself to the art of jungle photography. Although the technique of the sport of jungle photography is the ground work for the success in either, it must rest on the knowledge of the jungle and the habits of the animals with which you wish to get into contact. In other words to be a successful jungle photographer you should be, or should have been, a successful jungle hunter.

Rawdon Malet in his well-known book on big game shooting *Unforgiving Moments,* says, that Big Game photography is a very fine sport if indeed it is a sport at all, in the strict sense of the word. But it is no more a mere, an immediate, alternative, to shooting, than is watching a grouse's nest from a hide with a camera, the immediate alternative, to grouse shooting. They are two different pastimes, and when not abused, both extremely worthy, and as it happens readily interchangeable. But to suggest that the one is ousting the other among the young sportsmen of today is untrue. Many I think, try to take good photographs on their shooting trips but the number of young men who say, 'I will not take a rifle this time but a camera' are few and far between. I deprecate the idea that photography and shooting are identical except for the click of a trigger or a shutter. They differ fundamentally because in the one case, one sets out to kill, a primitive instinct, in the other to make a picture by modern scientific methods. I cannot see, however, any chance whatever of humanitarian feeling reaching such a pitch in the next hundred years that killing for sport will cease to be. The desire to take part in blood sports will not alter. The way in which they are carried out will. Man is a hunting animal—how often has that truism been made? Books of the Trader Horn variety find a wide public; films 'of the wild', some of them cruel and unsporting to a degree, draw a large and enraptured audience. No—there is no sign that in the next hundred years public opinion will stop the shooting of big game by fair sporting methods.

I may rebark here that besides shooting several *Dicerorhinus sumatrensis,* the double-horned rhinoceros of Burma, which as previously stated are the smallest and most hairy of all the five species of rhinoceroses in the world, I think I can safely say that I have also seen at close quarters more of these animals in their wild state in Burma than any other living European or Asiatic sportsman. I might also add that I could have shot many more of these animals than I did, as I was given many more opportunities than I availed myself of.

My experiences of the double-horned rhinoceros over a great number of years during which period I suppose I have seen between twenty and thirty of these animals, have been that they are as active as goats and are also expert hill climbers. They will negotiate country that neither elephant nor bison could possibly surmount. Year in and year out I have frequently found them at the tops of the steepest of hills drinking and wallowing in clear hill streams at heights varying from 1,300 feet to 1,400 feet, with not a vestige of mud or muddy water to be found anywhere except in wallows in low ground at the foot of the hills, miles away near permanent streams, which proves what I have said before, that this rhinoceros is an extremely active beast. Another example of their activeness is that rhinoceros get to their feet when disturbed and dash away at a much greater speed than would appear to be possible for such a clumsy looking animal. I found that the double-horned Sumatran rhinoceros generally fed along steep well wooded valleys and also along the steep banks of well wooded mountain streams, most difficult country to get at, as a matter of fact, so far as the Arakan Hill Tracts District of Burma is concerned. The majority of these streams at the sources of which rhinoceros took up their abode are full of rocks, large boulders, high waterfalls, and dense cave and bamboo jungle. In these rocky hill tracts there are, with one or two rare exceptions, no mud wallows or mud baths of which these animals are so fond.

The only other wild animals of Burma that love to wallow in mud and water, are, the elephant, tapir, pig and sambar, *Cervus unicolor*. I noticed, however, that the Sumatran rhinoceros invariably had their baths in natural pools which had been hollowed out by the water at the foot of waterfalls. Fine gravel, stones and rock form the beds or foundations of these pools but there is no mud as is ordinarily found in most wallows used by *D. sumatrensis,* whilst there is usually about two or three feet of water in them. When feeding near these mountain torrents, rhinoceros just bathe where it suits them, that is to say, wherever there is sufficient water to cover their bodies when they roll about in it. The approaches to these mountain pools are in most cases very steep and inaccessible.

The climbing one has to do also when hunting these animals in these out of the way hilly localities is really prodigious and one has to be in the pink of condition to be able to keep going all day over some of the most trying country to be found any where in the world. One had often to make long detours to get round a succession of precipitous waterfalls as it was quite impossible to ascend or descend most of the beds of these hill streams. My hunters and I invariably carried about fifty or sixty yards of stout coir rope to enable us to surmount these waterfalls and steep ascents.

These remarks apply more particularly to the ranges of hills which skirt the Ru, the Lemro, and the Peng rivers in the Arakan Hill Tracts of Burma where the *D. sumatrensis'* is still fairly plentiful and where the hoarse bark of the 'gyi' or barking deer, the hoot of the gibbon, and the harsh calls of the larger horn bill *Dichoceros bicornis* may be heard intermittently from morning till night to the exclusion of all other sounds.

The only other parts of Burma besides the Arakan Hill Tracts, and the Ruby Mines Districts where I found *D. sumatrensis* fairly plentiful were along the tops and slopes of the Yomah hills, along either side of the watershed running between Arakan, that is to say the Kyautpyu and Sandoway districts, and the Thayetmyo District, but neither in the hills, on the watershed, and slopes between Arakan and Thayetmyo nor in the Shwe-U-daung range of hills in the Ruby Mines District did I find these animals in such inaccessible places as I found them in the Arakan Hill Tracts, especially among the steep hills which skirt the Peng and Lemro rivers near Pengwa where the Peng river joins the Lemro. I suppose they had been hunted so persistently and ruthlessly in these places by the hardy Chin hill tribes who occupy that part of the world that they were finally driven to occupy these inaccessible places.

When I was hunting big game in the nineties along the above-named watershed between Arakan and Burma I noticed that *D. sumatrensis* invariably had their wallows at the sources of streams and in springs as near the top of the watershed as possible. I noticed this more particularly during the months of September and October during the rains. Discarded wallows at lower elevations, dry, during the hot weather, that is to say from the beginning of March, till the beginning or middle of June are also used again during the wet weather. A *D. sumatrensis* may have half a dozen or more wallows which it knows of and which it visits at odd times, according to their dry or wet condition, but it does not necessarily have a daily mud bath. It depends a great deal on the general weather conditions and whether also a wallow exists near the ground it happens to be feeding on, but sometimes these animals also travel long distances to get to a wallow if the weather is hot and the horse- or gad-flies are troublesome. From the end of April and onwards until the rains set in, is the worst time for these pests. A rhinoceros like a pig and a buffalo must have its bath periodically, be it of mud or only pure clear water. I have seen elephants rolling about in the mud of a wallow to give their bodies a coating of it so as to protect their sensitive skins from the bites of insects.

Rhinoceros often feed on anything green they can get in the parts of the country about the Peng and Lemro rivers in the Arakan Hill Tracts. They must have been hard put to it at times to get anything at all succulent to feed upon in those steep inhospitable bamboo clad hills. Except for an occasional small patch, here and there, all evergreen forest in these areas seems to have been destroyed for cultivation purposes by the hill people by their wasteful system of felling timber and burning it. If it were not that the bamboo is a strong healthy shrub there would soon be none of this left either. Nothing can be seen for miles around but the 'Kayin wa', 'bamboo', *Melocanna bambusoides*. *D. sumatrensis* like most herbiverous animals, however, are very fond of the flowers and fruit of this bamboo as well as of the young shoots.

A rhinoceros is just like a big pig. It wanders about everywhere, north, south, east and west, as the spirit moves it. Once it has been disturbed or decides to change its feeding grounds, it is sometimes almost impossible to overhaul it. It travels at a quick pace for miles over the most abominable country imaginable, often in a straight line, until it reaches the desired spot which may be a luxuriant growth of dense jungle or a wallow.

Rhinoceros make a peculiar subdued, humming, rumbling, or buzzing sound when submerged in their wallows, especially when they have had to undergo a long journey during the heat of the day, or are tired. The sounds are made by the animal through having a feeling of contentment and pleasure at being immersed in the cool mud of the wallow. There is no mistaking the sound once it has been heard. The sound is always the same, it is never varied. I have heard it as a matter of fact on several occasions and it has been permanently impressed upon my memory, as well as upon the memories of my hunters and trackers, for we always made a point of discussing these sounds again afterwards everytime we heard them as they were so uncommon. They were doubtless made by the animal breathing or passing air through its throat and nostrils as a sign, presumably, of its pleasure at being immersed in the cool liquid mud of its wallow after doing a long journey in the sun. Naturally enough when it entered the wallow the animal's body would get cool again very quickly, whilst the coating of mud with which its body would get plastered after entering the wallow would protect it at once from the attacks of that dreaded pest of all animals the gadfly, or horsefly as it is sometimes called. It is only when they have been disturbed by human agency that they travel long distances by day, and it is because of an enforced journey of this kind, during the heat of the day that their entry into a mud wallow causes them so much pleasure which they give vent to by making the sounds referred to. At other times rhinoceros usually feed and travel at night or in the very early hours of the morning.

Although I was, I suppose, the first European sportsman to refer many years ago, in the year 1900 to be precise, to these peculiar sounds emitted by *D. sumatrensis* when in their wallows I see that another writer, (in future in this article I shall refer to him as the 'other writer' when mentioning this and other subjects on which he and I have touched, and not quite seen eye to eye, when discussing matters connected with *D. sumatrensis*, when referring to this subject in the year 1939, seems to have found it a little difficult to describe these sounds with sufficient clarity, and certainly not at all like the sounds heard and described by me. I will therefore have a friendly exchange of views with him on this matter in this article. He, I may say, is the only writer excepting myself who has ever touched on the subject of the noises made by a *D. sumatrensis* rhinoceros when in its wallow. He, the 'other writer', says, 'there is a peculiar noise that a rhinoceros makes when in a wallow. This is a distinctive sound and not at all like a rhinoceros. The first time I heard it I was with the old Datok Raja and we could hear a rhinoceros splashing about in the wallow but could see nothing. Presently I heard a noise which I took to be made by a monkey evidently close to the wallow who had spotted the rhinoceros and that we must be careful that he did not spot us too. The old man smiled and shook his head. That is the rhinoceros, they make that noise when enjoying themselves in a wallow.' This statement of the Raja's it can at once be seen explains everything clearly and agrees with my conclusions and those of my hunters and trackers that these sounds (although the description of them as given by 'the other writer' are hardly correct) were uttered by the rhinoceros because the animal was extremely pleased at being submerged in the cool mud and water of its wallow. The 'other writer' goes on to say that he often heard that noise on other occasions and was often hard put to it to believe that it was really the rhinoceros and not a gibbon. 'The sound (he states) was low and rather plaintive, something like the low note of a White-handed Gibbon also with a resemblance to a bird. A noise impossible to describe accurately.'

This is a very vague description, and I am afraid I can hardly agree that the sounds made by a *D. sumatrensis* rhinoceros when in its wallow in Burma at any rate, resemble any noises emitted by either a gibbon or a bird except by the wings of the birds as mentioned by me in my book *Wild Sports of Burma and Assam,* and further on in this article. The 'other writer' does not even hint as to the kind of noises emitted by the bird referred to by him or the kind of bird. It is just possible of course, though highly improbable that the noises emitted by a *D. sumatrensis* when in its wallow in the country where 'the other writer' hails from, may differ somewhat from the sounds emitted by the same species of rhinoceros when it is disporting itself in its wallow in Burma. Another explanation may be that when 'the other writer' heard the sounds emitted by the animal when it was making them in its mud bath in his part of the world for some reason or other he did not hear them as clearly as I did when they were being uttered by the same species of animal when in its wallow in Burma. In that case naturally enough he would not be able to give as accurate a description of them as has been given by me.

As I stated before, I was probably the first European sportsman to write about these peculiar humming and buzzing sounds made by this rhinoceros when in its wallow. I had heard it on many occasions and as the sounds had been impressed on my memory I had no difficulty subsequently in describing them clearly on paper. All my hunters and trackers also knew them very well having often heard them in the jungle when out after rhinoceros and other big game. They had also discussed the matter among themselves and had heard the sounds described and repeated to one another so often that they became as familiar with them as I did, not only through hearing them so often in the jungle myself, but also through hearing them described and explained so frequently by my men.

If the reader will look at the foot of page 167 of the book *Wild Sports of Burma and Assam* by Colonel Pollok and W. S. Thom and which was published in 1900 and is now out of print, he will see recorded there the following, 'Should the rhinoceros be in his mud bath the sportsman will sometimes be made aware of the fact by hearing peculiar low, rumbling, humming sounds, the noise being very similar to that made by a species of large horn bill when soaring through the air, or like the sounds made by a vulture's wings when stooping to earth.' Surely there can be nothing clearer than this description? Then again on the top of page 176 of the same book see the sentence beginning with the words, 'patience is however usually rewarded in the end, and after many twistings and turnings, going over the same ground twice, we came upon fresh tracks and were suddenly startled by hearing the peculiar low muffled sounds repeated at intervals in our immediate neighbourhood which Maung Hpè my hunter at once recognized as proceeding from the rhinoceros'. Further on the same page namely 176, at line sixteen see the sentence beginning with the words, 'the peculiar low buzzing or humming noises became more distinct and as we rounded a rocky ridge which overlooked a shallow ravine wooded with bamboo and an undergrowth of prickly cane, a large mud wallow, in a small clearing bordering the cane jungle, came into view, and in this two rhinoceros were disporting themselves.

One animal the larger of the two, was standing half in and half out of the slushy mud; the other was lying in it half submerged rolling about from side to side and uttering the peculiar noises which had attracted our attention'. On page 178 of the same book, line 9, read the sentence beginning with the words 'whilst in the middle of our well-earned meal we were suddenly startled by hearing the peculiar muffled, humming sound, already referred to, and which seemed to proceed from no great distance. It ought to be apparent from these extracts that I was the first sportsman to record in detail my impressions of the sounds heard by myself and my hunters emanating from a *D. sumatrensis* rhinoceros when in its wallow enjoying its mud bath.

Has the reader ever heard the low subdued, rushing, humming, singing, or buzzing sounds made by the feathers of a vultures wings as they are spread out when the bird is soaring through the air at some speed and stooping and about to land on the ground, beside some dead animal; or an exactly similar noise made by the air passing through the feathers of the wings of the large horn bill, *Dichoceros bicornis,* as it passes over the tops of the trees in the jungle when soaring overhead with outspread wings? It is of course the wind passing through the tips of the feathers in the wings of both birds that causes them to vibrate and produce the low humming or singing noise one hears, which is so exactly like the sounds made by the rhinoceros when in its wallow. Perhaps the reader has not had the same opportunities that I have had of hearing them, as I have spent much leave and many happy days in the jungle alone with my hunters and trackers over a stretch of fifty years and was able to see, hear, and experience many strange things pertaining to the 'wild' that have not been vouchsafed to everyone.

There is no mistaking the sounds which are always alike and can therefore be easily described. I can only repeat that it is only when the wings of both birds are outspread and they are soaring or planing through the air at some speed that the sounds are made by the feathers of the wings and that these sounds are identical with the noises made by the rhinoceros when it is in its wallow. Surely some people must have heard the vibrating noises made by the wind passing through the wing feathers of the two birds referred to; and if they had heard the noises made by the rhinoceros as well they would immediately have come to the conclusion how exactly alike the two sounds were. These noises made by the rhinoceros when in its wallow besides being an expression of its satisfaction at being there are also made by the animal when it is either expelling or inhaling air through its nostrils, mouth, or throat. It stands to reason also that the animal must make some noise when clearing its nostrils and mouth of mud, as its head reaches the surface from beneath the mud after it has been submerging itself in it. It is only when it is carrying out these performances in the mud that these low deep muffled humming or buzzing sounds are heard. These sounds as I have stated before so completely resemble the sounds made by the wind passing through the wing feathers of both the vulture and the hornbill when they are soaring or planing at high speed through the air that I cannot think of, or find anything else which so completely resembles them. No other sportsman except myself and 'the other writer', to my knowledge, has ever referred to this subject.

Although the matter is not really of such paramount importance, I trust I may be pardoned for going somewhat into detail and enlarging on it to the extent that I have done in this article. My reasons for doing so were because I was not altogether satisfied with the description of the sounds emitted by the rhinoceros which were heard and recorded by 'the other writer' in 1939.

With regard to the other noises made by a rhinoceros apart from those made by the animal when it is enjoying itself in its mud bath the rhinoceros also utters a piercing long-drawn-out scream when it is about to expire after being fatally shot. When a rhinoceros is also hard-pressed and has been thoroughly alarmed by the hunter coming upon it suddenly at close quarters I have heard the animal dash off at a great speed uttering a succession of loud whistling, braying sounds, in different keys, not unlike the braying of a donkey. At other times when I have followed and came up with the animal that has suddenly got my wind, it usually uttered a terrific snort not unlike that emitted by a large boar or gaur *Bibos gaurus* before galloping off.

Here is another matter on which I regret to say 'the other writer' and I disagree and about which I propose having another friendly discussion with him in this article in the hope of being able to convince him that I am right and that he is wrong.

Burman hunters have informed me, and I have verified their conclusions, that they can easily distinguish between a male and a cow rhinoceros when following their tracks by noticing the way young saplings, creepers, or the branches of bushes have been twisted by the animal's horns as it moves along when feeding. My experience also is that a male or a cow with short horns cannot do much, twisting of creepers, twigs and branches as compared with a male with good sized horns as they cannot get a proper grip or hold with their short horns and the branches and saplings would then be more likely to slip off than if the horns were long. So far as I have been led to understand from my own observations and those of my hunters and trackers the more twisted the creepers, bamboos, and branches appear, the better are the chances of coming upon a male with a good anterior horn.

Another way of distinguishing sometimes between the tracks of a female and a male (there being very little difference in their size and appearance so far as *D. sumatrensis* are concerned) is by carefully noting the position of their droppings or dung. In the case of a male the ordure and urine will usually be found on the ground exuded one behind the other, a foot or two apart, at least, whereas in the case of a cow rhinoceros they will be found more or less together scattered over the bushes in the immediate vicinity at heights of from three to four feet. The urine of a cow as seen by me on numerous occasions was of a pale pinkish colour. According to the *Bombay Natural History Society's Journal*, however, it would appear that both sexes urinate from behind and between their legs for some distance so that the leaves of the surrounding trees and shrubs are sprinkled and it is evident that both sexes share the habit by which they may become aware of each other's presence in the dense recesses of the forests.

The male rhinoceros when twisting bamboos, young saplings, and creepers with its horns does so doubtless with the object either of cleaning or sharpening them or simply because of the pleasing sensation gained by the scratching. Perhaps it may be done as a challenge, or from cussedness or sheer 'joie de vivre'. Bison, or rather gaur, and Tsaing *Bibos frontalis*, or wild cattle, and ordinary domestic cattle, often tear up the ground with their hooves and horns or rub the latter on the branches of trees or saplings for no apparent reason; as do deer occasionally even when they have no velvet to get rid of, simply, I take it because the rubbing sensation pleases them. It may be of course a sex desire.

Burman hunters have often told me that all big game are more aggressive when the moon is on the increase and nearly full. Many races in India even believe that a human being is at his or her best when the moon is fullest.

To continue with the subject of the twisting of saplings and branches by a rhinoceros when feeding, 'the other writer' who also discussed the noises made by a rhinoceros when in its wallow and who gave a different description of them from that given by me has again differed from me as to the sex of the animal engaged in this wisting work and the why and wherefore of sapling twisting by rhinoceros in general with their horns when they are on the move, feeding. He, 'the other writer', says: 'A favourite trick of the rhinoceros when feeding is to get a sapling behind his front horn and twist it round and round until it is thoroughly decorticated and covered with mud from his head. I do not know exactly how this is done never having caught a rhinoceros 'flagrante delicto', but it is generally supposed this is done by a rhinoceros which has sufficiently long horns to enable it to twist the sapling between the two horns'. (This peculiarity of branch twisting by *D. sumatrensis* was also referred to by me in my book, *Wild Sports of Burma and Assam* and I suppose 'the other writer' and I are the only two sportsmen who have ever discussed this subject, as well as the subject about the noises made by a *D. sumatrensis* when in its wallow.) 'The other writer', goes on to say, however, that he found that this was not the case, for in one instance he was following a rhinoceros which had twisted a number of saplings but discovered that it had a very poor and stumpy posterior horn.' He says further, 'I believed for the same reason that a female rhinoceros could not twist saplings, and, when following rhinoceros spoor and finding twisted saplings, I concluded I was on the track of a male which had a good horn. I disproved this by finding saplings, twisted in the approved style by a cow rhinoceros which was accompanied by a calf. I do not now believe that the length of the horns has anything to do with the thoroughness of the twistings, and such indications are no guide either to the sex of the animal being followed or the size of the horns.' From this it will be seen that 'the other writer' and I disagree entirely in the conclusions arrived at by us. In any case it is not worth continuing the argument further and, right or wrong, the 'other writer' is just as much entitled to his opinions in this matter as I am to mine. It is obvious, nevertheless, whatever one may say to the contrary, that a male rhinoceros with a longish anterior and posterior horn is much more likely to make a better job of sapling twisting with its long horns than an animal like a cow rhinoceros or a male with short stumpy horns, neither of which would allow of a proper grip or hold being taken of any saplings and branches in order to twist them. They would in fact be more inclined to slip off. Surely this is obvious.

Anyway I think I have discussed this matter quite long enough. Besides I daresay my readers have been bored stiff from what they have already read on this subject as well as on the other one.

The tracking up of rhinoceros is often very difficult especially in the hills when the ground is dry and hard or when it is covered with a thick layer of dead bamboo leaves. Should tracking be interrupted by a heavy shower of rain the bamboo leaves swell out, then the front or centre toe nail impressions of the forefeet which are usually the only marks that are visible on the ground are invariably almost obliterated, when the utmost skill of the tracker is called into play. All rhinoceroses have three toes on the fore and hind feet unlike the tapir *Tapirus indicus* which has four toes on the front and three on the hind feet.

One rarely comes across a young rhinoceros. During the fifty odd years I have spent in the jungles of Burma I think I have only once seen the tracks of a young rhinoceros. Burmese hunters say that a rhinoceros bends its head to clear its path of obstructing jungle, and leaves dead logs and branches over its back as it proceeds. These fall on the youngster following on the heels of its mother and so kill or maim it. Hence the scarcity. This of course is a myth and cannot be accepted as a true reason. I referred to this subject in the Indian sporting paper the '*Indian Field*' in a long article entitled 'Notes on the Tapir', *Tapirus indicus* and '*Rhinoceros sumatrensis*' some 35 years ago. The '*Indian Field*' became defunct a number of years ago. The real reason I suppose why rhinoceros are so scarce is because they have been so systematically hunted down now for many years past in all parts of the country where they exist that they have no time even for breeding. The people are also well aware of the great value of the animal's blood and horns. The result is that the male are shot more frequently for their horns which are longer than those of the females which have small inferior horns; and, as I have stated before, rhinoceros were never prolific breeders, the female producing only singletons about one in twenty or twenty-five years, it can be understood that their chances of producing young ones are considerably lessened in consequence. Deterioration in horn development is also probably due to the persistent persecution and the killing off of better-horned animals and the breeding of poorer stock. The males consort with the females from the middle to the end of the rains, that is to say any time between July and October whilst the period of gestation is just a little over seven months.

I came upon and shot a very good specimen of *D. sumatrensis* rhinoceros on a range of hills bordering the Lemro river in the Arakan Hill Tracts of Burma at an elevation of above sea level of about 3000 feet. I was informed that there was a small pond or pool of water about two acres in extent which was situated on the top of a range of steep hills above the Lemro river. I was armed with a single 500 bore cordite rifle by Westley Richards which took a charge of 80 grains of cordite. After a fairly stiff climb through a nasty stretch of leech infested country we came upon a large pool of water where sure enough I saw a Sumatran rhinoceros with a good anterior horn standing beside the pool. I crept up to within twenty-five yards of the animal and let it have a raking shot through the small of the ribs in the hope that I would find the lungs if not the heart. The animal lurched forward on receiving the bullet and swung quickly round in my direction as if to charge. I then moved forward to a position some fifteen paces from the pool and as the rhinoceros reached the edge of the water on my side I dropped it with a broken shoulder and finished it off with a third shot. It had a very fair anterior horn of about sixteen and a half inches in length. The posterior horn was only from two and a half to three inches long. After my men had cut up the animal with the idea of returning on the following day to fetch away all the meat we hurried back to camp which was reached in inky darkness at about 9 o'clock at night after a desperate scrumble through the jungle and undergrowth, the leeches crawling all over us en route in battalions.

EFFECT OF DIFFERENT FOODS ON THE LARVAL AND POST-LARVAL DEVELOPMENT OF THE MOTH *PRODENIA LITURA* Fb. (LEPIDOPTERA, NOCTUIDAE)

BY

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(*With two graphs*).

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Introduction.

The larva of the moth *Prodenia litura* Fb. (Noctuidae, Lepidoptera) is an important pest of cauliflower in Bengal; it is called *kafipoka*, the cauliflower worm, by the peasantry. In the Tamil areas of the Madras Presidency the larva is known as *arakkan*. The depredation of the larva is not confined to any particular crop but extends over a number of economic plants and fruits in India as well as other parts of the world. In Egypt the larva is a great pest of cotton, and is known as the cotton-worm; in Nyassaland, the larva chiefly injures tobacco, and is popularly called the tobacco-caterpillar; in Rhodesia, it is known as the tomato-caterpillar; in Mauritius as the bean-enemy-worm.

The moth *P. litura* has been the subject of investigation by a number of authors: Wilcock (1905) furnished a list of hosts devastated by this caterpillar. Fletcher (1914) gave a short account of its bionomics, and published a list of plants which might be injured by the species. Janish (1930) made experiments on this moth under different temperatures and humidities. Bishara (1934) gave an elaborate account of the general morphology and bionomics of this species and also added a list of plants, fruits and flowers which are injured by the larva of *P. litura*.

From the list furnished by the previous authors it is seen that the larva of *P. litura* can grow on fifty-four different types of vegetable food-stuffs. So, a knowledge of other plants which are likely to harbour this pest, will be useful in checking the spread of its infestation from one plantation to another. I have endeavoured, therefore, in this paper to furnish a fresh list of hosts which are subjected to attack by *P. litura*. Further, since the pests have a wide range of host plants, it is important to know how far the duration of the life cycle as well as the size of the insect are influenced by the various food-stuffs, other factors such as temperature and humidity being kept constant.

The present problem was, therefore, undertaken with a view (1) to supply an additional list of hosts which can be infected by the larva of *P. litura*, and (2) to report variations in larval growth and period, pupal size and period, and the size of the adult caused by varying the food-stuffs. The feeding experiments were carried under room conditions during the winter months as well as under a constant high temperature of 30°C in an insectary fitted with a temperature-control apparatus. The main food-stuffs used in the experiments were cauliflower, green banana fruit, mulberry leaf, fresh cabbage, green papaya fruit, lettuce leaf, and the leaf of the silk-cotton tree.

ACKNOWLEDGMENTS.

I take this opportunity to express my gratitude to Dr. D. P. Raichaudhury, Lecturer in Zoology, for his constant help in this work, and to Mr. D. D. Mukerji, Lecturer in Zoology, for the general improvements of the paper. I also express my indebtedness to Prof. H. K. Mookerjee, for allowing me to carry on the work of research in the University College of Science and Technology, and financing the necessary expenditure to perform the requisite experiments; my thanks are also due to Mrs. D. P. Raichaudhury who allowed me to collect materials from her garden at Ballygunge Park.

EXPERIMENTAL.

1. *Materials.*

The specimens used in these experiments were reared in the laboratory. They were first obtained in the larval stages from an infected field at Ballygunge Park. They were also collected from Dhapa, situated on the outskirts of Calcutta. A few were obtained from cauliflowers sold in the market.

2. *Methods.*

For raising the stock, the moths were reared in the laboratory for several generations, the larvae being fed with cauliflower. Round glass jars measuring 4 inches in diameter and 6 inches in depth were used for all the experiments. The mouth of the jar was tied with muslin. Each jar was thoroughly cleansed and washed with sodium carbonate solution followed by lysol lotion.

To make a correct operation in the performance of the experiment, special precaution was taken against any chance of sudden shortage of food by providing each jar with large quantities of fresh leaves picked from the gardens, also with chips of the same. Evans (1938) noted that the larvae of *Pieris brassicae*, fed on cabbage leaves which were grown under bad conditions of light, behave differently from those fed on leaves grown under natural conditions of light, and Wigglesworth reported (1939) that increase of temperature stimulates metabolism leading to food shortage and death. At the initial stage of the experiments the food-stuff in each jar was changed twice till the advanced stage of the larva, when the change was made thrice daily.

Since this species pupates under earth a little below the soil surface as reported by Fletcher (1914) and Bishara (1934), saw-dust was put at the bottom of all the experimental glass jars for pupa-formation under artificial condition.

In the experiment No. 1, twenty kinds of vegetable food-stuffs were tried. Sixteen of these which are not star marked (vide list D) were found growing in close proximity to the plantation infested by the pest. For drawing this fresh list (vide list D) of plants subjected to the attack of *P. litura* larvae, with the exception of the star marked foods namely radish, apple, nashpati and papaya (where roots and fruits were fed) in all the cases, experiments were made with the leaves of the listed host plants. To economise the glass jars and check the results, the experiments were arranged in three sets, with seven glass jars in each set. A number of twenty larvae of *P. litura* were kept in each jar. The larvae were kept under observation until the pupal stage.

In experiment No. 2 the larvae were fed with the eight kinds of food-stuffs such as cauliflower, green banana fruit, mulberry leaf, lettuce leaf, cotton leaf, palam leaf, green papaya fruit and cabbage; and then the variations, in the size of the larva with their ages, pupal size and adult size were recorded. And also the durations of the larval period and pupal period were noted. These observations are given in different tables (Tables I—VII) and the rates of the different larval growths have been represented by Graphs A & B.

To conduct the experiment No. 2 under room conditions, twenty-four glass jars were employed. The jars were put in three different sets, each set containing eight jars. Food of one type was contained in three jars, one in each set, and eight kinds of food-stuffs were altogether tried. The object of having three sets is to ensure the continuation of experiments, if accidentally specimens in any one set die for one reason or other. As it was observed that if more specimens are kept in the limited space of a single jar, overcrowding occurs and they do not thrive well; hence in each of these jars ten freshly emerged larvae of the same parents were kept. The variations observed in these sets are given in tables. For comparison of the different larval sizes, they were measured at an interval of five days, till the larva attained the prepupal stage. Further, for recording the pupal duration, as soon as the pupae were formed in the eight respective foods, they were transferred in different jars, but having identical environmental conditions, and the time at which the imago emerged was correctly noted. This gave the duration of the pupal life.

To conduct the experiment No. 2 under high temperature the same method was followed, but with the difference that in this experimentation the larvae were measured at intervals of four days instead of five, since the rate of the larval growth was accelerated due to the rise of the temperature. The results have been tabulated in different tables.

For the different tables, the linear growth of the larvae and the size of the pupae and imagoes were measured by an ordinary scale. But in case of the newly emerged larvae which were too small to be measured by a scale, they were measured by stage micrometer. The different measurements shown in tables are the average of ten readings. The full length of a larva and pupa means distance from tip to tip and the breadth shows the maximum width of the fourth abdominal segment. In references to the procedures provided by Lefroy and Howlett (1909) and Fletcher (1914), the body length and the abdominal size at the greatest diameter of the imago were recorded. And the expansion of the wings (fore and hind) was measured from the distal end of the one side of the wing (fore and hind) to the distal end of the other side of the wing (fore and hind). The distal width of the individual fore and hind wings was noted from the greatest distal area of each wing. To have a single standard of measurement, the fore wing was measured along the subterminal line as referred by Torre-Bueno (1937); and the hind wing was measured from the greatest width at the posterior terminal area of the hind wing.

3. *Observations.*

To the list of vegetables and plants, damaged by *P. litura*, reported by previous authors (shown here in columns A, B, C)—twenty more are added by the present author and these are shown in column D. The fact that this insect also attacks such fruits as apple, papaya, etc. shows the wide range of host plants.

List of hosts.

The following is the list of vegetables, foliages, fruits, etc. damaged by the moth *Prodenia litura.*

Wilcock's list
(A)

1. Cotton.
2. Bersin (Egyptian clover).
3. Lucerne.
4. Maize.
5. Pea-nut.
6. Beet.
7. Sweet potato.
8. Colocasia.
9. Potato.
10. Leaf beet.
11. Mallow.
12. Jew's mallow.
13. Spinach.
14. French bean.
15. Leamia (*Hibiscus esculentus*).
16. Til (*H. cannabinus*).
17. Red pepper.
18. Tomato.
19. Grape vine.
20. Sweet orange.
21. Plum.
22. Mulberry.
23. Crysanthemum.
24. Castor.

Bishara's list
(B)

1. Wheat.
2. Rice.
3. Bledi beans.
4. Soya beans.
5. Fenugreek.
6. Egg-plant.
7. Water melon.
8. Cucurbit.
9. Cabbage.
10. Onion.
11. Mandarines.
12. Guava.
13. Fig.
14. Poplar.
15. Banana.
16. Rose.
17. Mint.
18. Viola.

Fletcher's list
(C)

1. Castor.
2. Tobacco
3. Maize.
4. Tomato.
5. Colocasia.
6. Agathi.
7. Jute.
8. Indigo.
9. Lucerne.
10. Brinjal.
11. Cabbage.
12. Elephant yam
13. Pea.
14. Plantain.
15. Grass.

Writer's list of additional food-stuffs.
(D)

1. Jamrul (*Eugenia malaccensis*, Lin.).
2. Karamcha (*Carissa carandas*, Lin.).
3. Jack tree (*Artocarpus integrifolia*, Lin.).
4. Sajna (*Moringa pterygosperma*, Gaertn.).
5. Aswatha (*Ficus religiosa*, Lin.).
6. Lettuce (*Lactuca scariola*, Lin.).
7. Celery (*Apium graveolens*, Lin.).
8. Cauliflower (*Brassica oleracea*, Lin.).
9. Shaddock (*Citrus medica*, Lin.).
10. Palam (*Spinacia oleracea*, Lin.).

*11. Radish (*Raphanus sativus*, Lin.)

*12. Apple (*Pyrus malus*, Lindl.).

*13. Nashpati (*Pyrus sinensis*, Lindl.).

14. Aparajita (*Clitoria ternatea*, Lin.).
15. Hasna-hena (*Cestrum nocturnum*, Lin.).
16. Thusa (*Thuya orientalis*, Lin.).
17. Ata (*Anona squamosa*, Lin).

*18. Papaya (*Carica papaya*, Lin.).

19. Mango tree (*Mangifera indica*, Lin.).
20. Ashshaeorah (*Glycosmis pentaphylla*, Corr.).

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* Are root and fruits.

TABLE·I

Effect of different foods on the larval growth of *P. litura*, reared under room conditions (average temp. 19·5°C): the sizes were recorded at *intervals of five days*

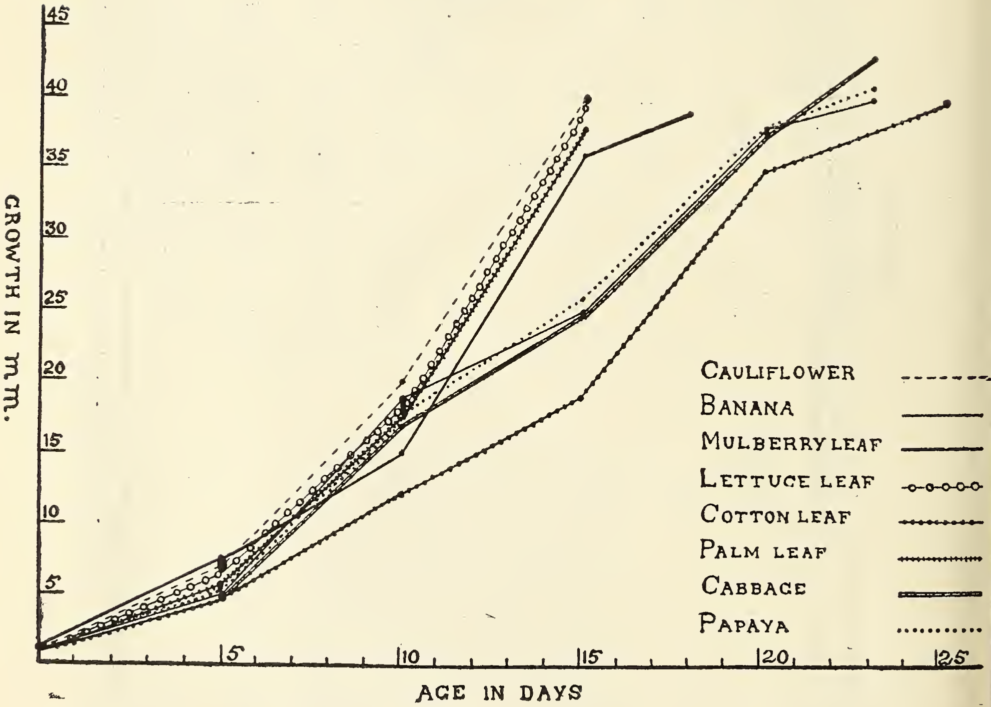
Food	Size of freshly emerged larva	Sizes of the larva in mm. after—				
		5 days	10 days	15 days	20 days	25 days
Cauliflower		7·00 × 1·1	20·30 × 3·6	39·60 × 6·6	–	–
Banana fruit (green)		4·60 × 1·0	19·00 × 3·0	25·00 × 4·1	37·60 × 5·3	*40·30 × 6·3
Mulberry leaf		7·00 × 1·0	15·30 × 3·0	36·00 × 5·0	*38·65 × 5·9	–
Lettuce leaf	1·06 × ·22 mm.	7·30 × 1·0	19·00 × 3·3	40·30 × 6·3	–	–
Cotton leaf		5·30 × 1·0	12·00 × 2·0	19·30 × 3·6	35·00 × 5·0	40·31 × 5·3
Palam leaf...		6·60 × 1·0	18·60 × 3·3	38·30 × 5·6	–	
Cabbage		5·70 × 1·0	18·00 × 3·0	25·00 × 4·0	37·60 × 5·3	*43·30 × 6·3
Papaya fruit (green)		5·86 × 1·2	19·25 × 3·5	26·35 × 4·6	38·45 × 5·1	41·45 × 5·9

* after 3 days, because the larvae reached the prepupal stage earlier. – Specimen pupated.

The effect of different food-stuffs in inducing variation in the larval sizes, under room conditions are shown in table I. It may be seen from the table that while the variation on the 5th day of observation is negligibly small, that on the 10th day is large; further variations become appreciably large in the case of cauliflower and cotton leaf. On the 15th day, the increase is noticeable in four examples—cauliflower, mulberry leaf, lettuce leaf and palam leaf. These sizes are distinctly larger than with banana fruit, cabbage and papaya fruit. Further it is worth noting that the largest larval size is attained in case of cabbage, while papaya comes next. The sizes reached by the larvae when fed respectively on banana, lettuce and cotton are more or less equal. The smallest larval size is found with mulberry and the palam. The cauliflower as diet occupies an intermediate place so far as its effect on size is concerned.

The rate of larval growth is shown in graph A. It may be noted that the rates of the larval growth as fed on different foods are practically identical for the first five days. Differences become observable onwards from five to ten days. During these periods the growth in case of cauliflower is highest, while it is smallest in the case of cotton. Further it is seen that the lines in the graph representing the larval growths for cauliflower, mulberry, lettuce and palam bifurcate at the 10th to 15th as these slope up. On the other hand the rates of growth at this period with papaya, banana and cabbage are comparatively small; hence they shift downwards as shown by the growth lines in the graph. The line representing the rate of the larval growth in cotton stands last.

GRAPH A



Graph A, showing the variations in the rate of the larval growth, in *P. litura,* when reared under room conditions (average temp. 19.5°C) on various foods. The growth means linear size.

Taple II shows the different sizes attained by the larvae of *P. litura* while kept under high temperature, other conditions being equal. This table shows that the variation in the larval sizes on the 4th, 8th, 12th day, etc.,

TABLE II

Effect of different foods on the larval growth of *P. litura*, reared at a high temperature (30°C) : the sizes were recorded at *intervals of four days*

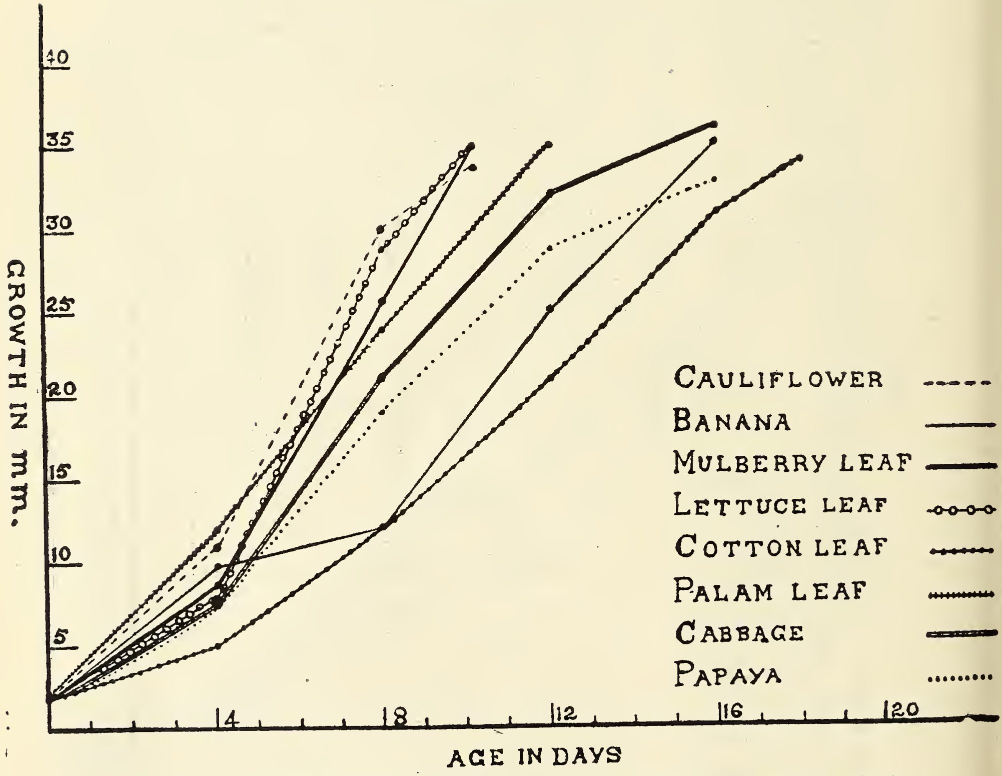
Food	Size of freshly emerged larva	Sizes of the larva in mm. after –				
		4 days	8 days	12 days	16 days	20 days
Cauliflower	1·81 × ·26 mm.	10·75 × 2·5	29·66 × 5·2	*34·16 × 6·0	–	–
Banana fruit (green)		4·71 × 1·1	11·83 × 2·1	25·25 × 4·0	35·20 × 6·4	–
Mulberry leaf		9·33 × 2·0	26·00 × 4·6	*34·91 × 6·0	–	–
Lettuce leaf		8·41 × 2·1	29·20 × 4·9	*34·80 × 6·1	–	–
Cotton leaf		4·81 × 1·0	12·10 × 2·5	21·25 × 3·5	30·66 × 4·6	*34·9 × 5·9
Palam leaf		12·01 × 2·0	24·00 × 4·0	35·33 × 6·0	–	–
Cabbage		8·33 × 2·0	20·51 × 4·0	32·00 × 5·2	36·00 × 6·1	–
Papaya fruit (green)		8·00 × 1·8	19·00 × 3·3	29·40 × 5·5	33·40 × 5·8	=

* after 2 days, because these larvae reached the prepupal stage earlier. – Specimen pupated.

occurs in proportion to their growth sizes under the room condition, only the sizes at the different ages of the larvae reared on palam indicate their rapid growth at high temperature. This table also shows that the larvae maintained on cabbage attain the greatest size as in Table I, but at the final stage, the larval size attained with papaya, banana, lettuce, cotton, cauliflower, palam and mulberry as given in this table (Table II), does not follow the order seen in Table I. It is also found that at the final stage the sizes of the larvae are comparatively smaller than the respective sizes noted under the room condition.

Graph B shows variations in the rates of the growth of larvae, four days old, reared on the different diets. The rate of the larval growth in this period is appreciably greater with palam leaf and cauliflower, and less with banana and cotton. Between the ages of four and eight days, the rates of the larval growth with cauliflower, lettuce and mulberry are more accelerated than in other cases. The graph in general coincides with the previous graph but the lines representing the rates of growth are more straight, specially the ones representing the rate of the larval growth with cauliflower, lettuce, mulberry and palam which slope rapidly up as compared with cabbage, papaya, banana and cotton. The growth with cotton shows periodicity.

GRAPH B



Graph B, showing the variations in the rates of the larval growth in *P. litura,* when reared in a high temperature (at 30°C) on various foods. The growth means linear size.

Table III shows the durations of the larval stadium as observed under the room condition and under the high temperature. In the experiment under room condition, the duration of the larval period with cauliflower is the shortest, while with cotton it is relatively prolonged. Results under high temperature too follow this order. Here also the margin between the larval durations

TABLE III

Effect of different foods on duration of larval life of *P. litura*, under the room condition (average temp. 19·5°C) and in a high temperature (30°C) experiments.

Food	Larval duration in days, under	
	Room condition (19·5°C)	High temperature (30°C)
Cauliflower ...	18	11
Banana fruit (green) ...	26	17–19
Mulberry leaf ...	20–21	12
Lettuce leaf ...	18–19	12
Cotton leaf ...	27–28	19–20
Palam leaf	19–20	12
Cabbage	25	17
Papaya fruit (green) ...	26	17

respectively experimented with cauliflower and cotton is very broad. It may be pointed out that as the effect of high temperature the duration of the larval period is shortened on an average by 7-8 days.

Table IV shows the variations in the sizes of the different pupae as observed under room condition and in a high temperature experiments. In the experiment under room condition, the largest pupal size is obtained with larvae fed on cauliflower and next in order come lettuce, palam and mulberry.

TABLE IV

Effect of different foods on the pupal sizes of *P. litura*, under room condition (average temp. 19·5°C) and in a high temperature (30°C) experiments.

Food	Sizes of the pupae in mm. under	
	Room condition (19·5°C)	High temperature (30°C)
Cauliflower ...	19–22 × 7–8	18–19 × 6–7
Banana fruit (green) ...	17–18 × 5–6	16–17 × 5
Mulberry leaf ...	19–20 × 6–7	18–19 × 6
Lettuce leaf ...	20–21 × 6–7	18–19 × 6
Cotton leaf	14–16 × 4–5	15 × 5
Palam leaf	19–21 × 6–7	18–19 × 6
Cabbage	19–20 × 5–6	17–18 × 5–6
Papaya fruit (green) ...	19–20 × 5–6	17–18 × 5-6

The sizes of the pupae experimented with cabbage and papaya are equal, but they are larger than with banana, the smallest pupal size being with cotton. Pupae reared under high temperature, but with identical food-stuffs, show a general reduction in their sizes as compared to those under the room condition.

TABLE V

Effect of different foods on the duration of pupal life in *P. litura*, under room condition (average temp. 22·2°C) and in a high temperature (30°C) experiments.

Food	Pupal duration in days, under	
	Room condition (22·2°C)	High temperature (30°C)
Cauliflower ...	9	6–7
Banana fruit (green) ...	11	9
Mulberry leaf ...	10	8
Lettuce leaf ...	9	7-8
Cotton leaf ...	12	10
Palam leaf	9	7
Cabbage	11	8–9
Papaya fruit (green) ...	11	8–9

Table V shows the durations of the pupal period as observed under both the experimental conditions. This table reveals that the durations of the

TABLE VI

Effect of different foods on the sizes of the moth, in *P. litura*, when reared in a room condition (average temp. 19°–22°C).

Food	Body length	Abd. width	Fore wing		Hind wing	
			Expanse	Distal width	Expanse	Distal width
	mm.	mm.	mm.	mm.	mm.	mm.
Cauliflower ...	19–22	6–7	38-40	8–9	30–32	11
Banana fruit (green).	17–18	4–5	34–36	7–8	26–28	8–9
Mulberry leaf ...	19–20	5–6	36–38	8-9	28–30	10-11
Lettuce ...	20–21	5–6	40	9	30–32	10–11
Cotton leaf ..	14–16	3–4	32–34	7–8	24–26	8
Palam leaf ...	19–21	5–6	38–40	9	30–32	11
Cabbage ...	19–21	4-5	34–36	7–8	26–28	8–9
Papaya fruit ...	19–20	4–5	34-36	8	26–28	8–9

pupal life is slightly variable. Under room conditions the duration if pupal life is shortest with cauliflower, lettuce and palam. The mulberry leaf stands next in order. The pupal durations with banana, cabbage and papaya slightly exceed these and are more prolonged with cotton. The results observed in the high temperature experiment also indicate that the shortest duration occurs with cauliflower, palam, mulberry and lettuce. The durations of pupal life with cabbage, papaya and banana are practically the same; with cotton however it is maximum.

Table VI shows the variations in the sizes of the different moths as observed under the room condition. This table shows, that under such condition, the largest size of the moth is obtainable if reared on cauliflower, mulberry, lettuce and palam. The next sizes are obtained with banana, cabbage and papaya; while those reared on cotton are the smallest in size.

Table VII shows the variations in the sizes of the different moths, observed under the high temperature, other conditions being the same as before. The size of the different moths stands in the same order as in the previous table. Further it is seen that in the high temperature condition the sizes of the different moths are smaller as compared to those bred under the ordinary room condition.

TABLE VII

Effect of different foods on the sizes of the moth, in *P. litura*, when reared in a high temperature (30°C).

Food	Body length	Abd. width	Fore wing		Hind wing	
			Expanse	Distal width	Expanse	Distal width
	mm.	mm.	mm.	mm.	mm.	mm.
Cauliflower ...	18–19	5–6	36–38	8	26–28	10
Banana fruit (green).	16–17	4–5	32–34	8	24–26	9
Mulberry leaf ...	18–19	5–6	34–36	8	26–28	10
Lettuce leaf ...	18–19	5–6	36–38	8	26–28	10
Cotton leaf ...	14–15	4	30–32	7	24	8
Palam leaf ...	18–19	5–6	36–38	8	26–28	10
Cabbage ...	17–18	5	34–36	8	24–26	9
Papaya fruit (green).	17–18	5	34–36	8	24–26	9

Finally with regard to time for completing the life cycle, i.e., the period from the hatching of larvae to the emergence of imago, under the room conditions, was 27 days with cauliflower, 37 days with banana and papaya, 31 days with mulberry, 28 days with lettuce, 40 days with cotton, 29 days with palam, 35 days with cabbage; while in the high temperature the period covered 18 days with cauliflower, 28 days with banana, 20 days with mulberry and lettuce, 30 days with cotton, 19 days with palam, 26 days with cabbage and 29 days with papaya. It is interesting to note that by comparison with the temperature of room conditions the heat factor has uniformly reduced the duration on an average by 9-10 days.

Discussion.

Certain species of lepidoptera can live on different varieties of food-stuffs, while others thrive only on some specific plants. The larvae of the moth *P. litura* belong to the first category, according to the information given by

Wilcock (1905), Fletcher (1914), Bishara (1934) and the additional list provided by the present experiments.

To inquire into the influence the various food substances exert on the different stages of development of *P. litura*, experimental feeding under room conditions was arranged during the winter months. But owing to diurnal and seasonal temperature fluctuations, the investigation was also conducted at a constant temperature. Further, as the room condition experiments were performed during the winter season they were practically at low temperatures. It was thought therefore necessary to hold the experiments at a high temperature too. Now as to the effect of temperature on the life of the moth, Janish (1930) found that at 29°-30°C, *P. litura* develops rapidly and reaches its physiological death within the shortest time. He considered this temperature as the optimum temperature. Bishara (1934) however reports that high temperature begins at 28°C. The temperature 30°C was therefore preferred for the high temperature experiments.

From Table I and Graph A, it is seen that the course of the larval development is affected by the different food-stuffs. It is particularly proved between the two sets of the larval sizes on the 15th day, in Table I. Here the larger sizes of the larvae fed on cauliflower, lettuce, mulberry and palam food, are for reaching the last larval stage earlier, due to the rapid growth induced by the respective food-stuffs. Whereas papaya, banana and cabbage made smaller size larvae respectively, by prolonging the larval stages due to the slow growth induced by these food-stuffs. Apparently for these in Graph A, the lines representing the larval rate of growth in the former set of foods, between the ages of ten to fifteen days, move quickly upwards, while the lines showing the larval rate of growth in the latter set of foods in the corresponding period, comparatively shift downwards. These facts suggested therefore that the food ingredients, needed for the larval growth were different in these two sets of food-stuffs. A similar observation was made by Sattler (1939) on the nun moth, *Lymantria monacha*. By feeding the larva with oak, larch and spruce, the larvae showed rapid development. The rate of the larval growth slowed down when fed with beach, apple and pine; while adler prolonged considerably the larval period. Again from the sizes attained by the different larvae at the last stage in Table I, it follows that the food has a very little effect on the final size of the larvae. But the fact, that in case of the food substances such as mulberry leaves, the size dwindled down below the average, shows however that nutrition does affect the final size. But on careful thought the explanation suggest itself that the size is not adversely affected, because, all the different food substances may contain the same essential ingredients needed for the final size, while the size is affected where these essentials are lacking in the food-stuffs.

From Table II, it is seen that the high temperature in different food-stuffs, causes appreciable variations at the age of 4, 8, etc. days. The marked variations in size of the 4th and 8th day, as compared to results obtained in the experiment, conducted at room temperature are evidently due to acceleration of growth induced by high temperature. This is why in Graph B, the lines representing the different rates of larval growth are straight in comparison with those in Graph A. As it is known that heat within the vital limit increases the rate of all metabolic processes, and in the developmental stages, the extra energy is expended on growth which is correspondingly accelerated (Uvarov 1931, Wigglesworth 1939), the slight irregularities in the position of the larval last stage sizes, in the different food-stuffs in this table, in comparison to Table I, suggest that in the high temperature experiment the developing larvae did not utilise the respective food reserves satisfactorily for the rapid larval growth, due to the rise of temperature. Moreover in general the reduction of the larval sizes in Table II, in comparison to Table I, is explained by the fact that, decidedly in low temperature, the percentages of food absorbed and utilised by the different larvae for building up the tissues, are greater than those at the high temperature. These are not only theoretical considerations, but facts proved exactly by Uvarov (1931) from the results of various authors.

From Table III it is proved that the duration of the larval period undergoes variations, and this is entirely dependent on the type of food the larva utilises during its larval period. The quick growth of the larvae with cauliflower accelerated the usual rate of growth in *P. litura*, and consequently the larval duration was shortened; and similarly the reverse effect occurred in the fate of the larvae fed on the cotton leaves and apparently their larval period is prolonged. Further the general shortening of the larval periods at the high temperature is accounted for since the food-stuffs remained constant in both the experiments. Uvarov (1931) has forwarded a considerable number of experimental results from different authors. According to him Standfuss (1896) recorded that, by the application of a high temperature, the larval period of *Lasiotampa quercifolia* L. can be shortened from the normal 22-26 to 7-12 weeks.

From Table IV it is seen that the size of the pupae is affected by the different foods. The pupal sizes in *P. litura* are therefore solely dependent on the nutritive effect of the individual food. In view of this table it is proved that cauliflower stands first, next lettuce, palam, and mulberry; cabbage and papaya are equal, but richer than banana; and cotton is very poor. Further it is seen from the table that the high temperature in general reduces the sizes of the different pupae from the different foods, in comparison with their respective sizes noted in the room condition. Again from both the results recorded, it is interesting to note that the largest size larva is not the producer of the greatest size pupa.

From Table V it is seen that the food-stuffs cauliflower, lettuce, palam and mulberry have got the greatest food values for the shortening of the pupal period; the food values are ordinary for banana, cabbage and papaya, and very poor in the case of cotton leaves. Further it is seen in this table that there is a general reduction of the pupal period in the high temperature obviously due to the rise of the experimental temperature, since the food-stuffs remained constant in both the experiments.

From Table VI it is proved that the size of the moth depends on the type of nutrition during its larval period. In view of the present results it is evident that the best nutrition in *P. litura* is derived from cauliflower, lettuce, palam and mulberry, and then from banana, cabbage and papaya. It is worth mentioning that cauliflower has produced the greatest body length and abdominal breadth of the moth. Further, the expansion of the fore wings and the hind wings are greatest in the moths with cauliflower, lettuce and palam, but they are comparatively smaller with mulberry. Regarding the greatest distal width of an individual fore wing and hind wing, it is marked that the variations are like the variations in the body length, abdominal breadth and expansions of the wings. Also it is worth noting the fact that the greatest size larvae do not produce the greatest size moths, as in Table I the greatest sizes are found associated with cabbage, but here (Table VI) with cauliflower. A similar observation has been made by Alpatov (1929) in his thyroid gland feeding experiment with *Drosophila melanogaster* Mg. He found that the larvae in the hog muscle and thyroid are larger than the larvae in the hog muscle and yeast, but finally observed that the imagos of the former are smaller than those of the latter.

From Table VII it is proved that in the high temperature, the sizes of the different moths become more reduced than their respective sizes noted in the room condition (Table VI) with the respective food-stuffs. As foods remained constant in both the experimentations, this is certainly due to the heat effect. While high temperature has a certain effect on the larva and pupa in their sizes and durations, now it is seen that it affects also the sizes of the moths. A brief review of similar results has been forwarded by Uvarov (1931). According to Uvarov, Titschak (1925-27) in his experiments on the clothes moth, *Tinola bisellella* Hum., demonstrated that at lower temperatures, larger and heavier moths are produced. Similar conclusions as to lower temperatures producing insects of larger size have been reached by a number of other investigators, e.g., Alpatov and Pearl (1929) with *Drosophila melanogaster* Mg., by Schlottke (1926) in the case of *Habrobracon juglandis* Say., by Musconi (1924) with *Calliphora erythrocephala* Mg., by Dewitz (1913) with *Porthelria dispar* L., and by Standfuss (1896) with various species of lepidoptera.

Now in ending the discussion it is well to mention that, since it is proved that the larval growth, larval duration, pupal size, pupal duration and the size of the moth in *P. litura* are entirely dependent on the qualities of the food it utilises during its larval period it would be unwise to criticise or evaluate the results forwarded by the previous authors such as Fletcher (1914), Janish (1930) and Bishara (1934).

SUMMARY.

1. Experiments were conducted for observing the infestation of the *P. litura* larva; it was noted that the larval food selection was very plastic, including leaves, fruits and roots.

2. Experiments were also arranged to observe the effect of eight different foods upon the life of *P. litura* under the room condition in the winter months and in a high temperature at 30°C.

It was found that under the ordinary room condition and in the high temperature (30°C.) experiments, when the larvae of *P. litura* were fed with eight different selected foods, they underwent variations in the larval growth, larval period, pupal size, pupal period and the size of the moths. When fed with cauliflower, mulberry, lettuce and palam the larval growths were most rapid, the larval durations shorter, the pupal sizes largest, the pupal durations hastened, and larger size moths were produced; when fed on banana, cabbage and papaya, the larval growths were ordinary, larval durations prolonged, pupal size medium, pupal durations lingered and medium size moths were obtained; when fed on cotton leaves, the condition of the larval growth was very poor, larval duration much delayed, pupal size very small, pupal duration comparatively prolonged, and very small size moths were produced.

It was also proved that there was a comparatively rapid larval growth, shorter larval duration, smaller pupal size, faster pupal duration and a smaller size moth in the high temperature experiment.

CONCLUSION.

The larvae of *P. litura* can devastate seventy-four types of different foodstuffs.

The larval growth and duration, the pupal size and duration, and the size of the moth in *P. litura* are dependent on the type of the food the larva utilises during its larval period.

Quick growth shortens the life cycle and the processes are more hastened in the high temperature.

Decidedly low temperature produces bigger size larva, pupa and imago, and the high temperature has an adverse effect on the different sizes.

The largest size larva in *P. litura* is not the producer of the biggest size pupa and moth, but the latter are solely due to the type of ingredients contained in the food utilised by the larva.

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OBITUARY

HUGH WHISTLER

The death of Hugh Whistler at the early age of 53, is a serious blow to the study of Ornithology in India, and a great loss to the Society. He was born in Lincolnshire on 28th September 1889. In 1909 he was appointed to the Indian Police, and went out to India in December of that year. His first station was Phillour, and he afterwards served at Rawalpindi, Ferozepore, Jhelum, Gujranwala, Ambala, Jhang, Kangra, and Simla; while on short leave he visited Dalhousie and Kulu, as well as Kashmir. By the time he retired Whistler had very wide knowledge of the whole of the Punjab and its avifauna. Wherever he went he noted and collected birds, and the great store of knowledge he accumulated was communicated to the *Journal* and the *Ibis*. While stationed at Rawalpindi he received a letter from the late Dr. C. B. Ticehurst, and this was the beginning of a long correspondence and intimate friendship. This friendship did much for Whistler, since it was through his acquaintance with Ticehurst he had his first introduction to systematic ornithology. In later years he also owed much to his help and guidance, which was always readily admitted by Whistler. On the other hand, it was through Whistler that Ticehurst took up the study of Burmese birds with such valuable results. Shortly after the last War three of our oldest members, W. S. Millard, Sir George Lowndes, and the late F. J. Mitchell, agreed amongst themselves to guarantee the publication of a popular illustrated work on Indian birds, if a suitable author could be found. Whistler was approached to undertake the authorship and a happier selection could not have been made, for he had the requisite knowledge with a pleasing literary style. The success of the book is shown by the fact that it has now passed through three editions.

Early in 1925, Whistler married Margaret Joan, second daughter of Lord Ashton of Hyde. A little later he and his wife went out to India and for some months were stationed at Simla, and later transferred to Rawalpindi. In April 1926 he took leave pending retirement, and left India. Two years later he again returned on a visit to Kashmir with the late Admiral Lynes and B. B. Osmaston. Shortly after the party had left Srinagar, Admiral Lynes was recalled home, but he insisted that his companions should continue with their collecting as originally planned. The trip was a great success and some of the higher and less known parts were visited. For the next few years Whistler settled at Battle, Sussex, where he worked at his birds. Nearly every year both he and Dr. Ticehurst made short collecting trips to some part of the continent; sometimes Mrs. Whistler was included in the party, and when Ticehurst was unable to accompany them Whistler went alone. When the Society was carrying out the Survey of the Eastern Ghats, Whistler was asked to work out the collections. He threw himself wholeheartedly into the work with the result that his series of papers were practically a review of the birds of the Peninsula; he also worked out the birds of the different State Surveys. In 1928 he was approached by the Society to contribute a series of articles on the study of Indian birds. To do justice to the subject meant a great deal of preparation, and few who read the articles realised how much time Whistler spent in preparing them. But the results, judging by the many appreciative letters he received, fully justified the trouble. It was about this time that Ticehurst and Whistler began to write a Handbook of Indian Birds. The second edition of the Fauna had several obvious shortcomings, and in the new work the authors intended to pay special attention to plumages, differentiation of the sexes, and distribution. Whistler had hoped to complete the book after the death of Ticehurst, but his increased civil duties left him little spare time and only a small part of the work has been completed. A few years before the War the British Museum and Colombo Museum had together carried out a survey of the birds of that island, and Whistler prepared a report on the collections, but owing to the difficulties during the War he did not live to see it published.

Hugh Whistler was careful and painstaking in his work, and had no use for the careless observer or slip-shod worker. He was always ready to help brother ornithologists, whether a beginner or a fellow worker. In his civil life in Battle it was the same; he was consulted by everyone and was greatly respected by his large number of friends and fellow councillors. In 1941 he was elected Vice-Chairman of the Battle Rural District Council, and was responsible for the civil defence and other matters over a large part of East Sussex adjoining the Coast. He will be sadly missed by his many friends both in India and at Home.

N. B. K.

MISCELLANEOUS NOTES

I.—AN INTERESTING TIGER SHOOT.

During my recent visit to Sirmur State, a shooting camp was arranged for me at Majra about twenty miles from Nahan, the Capital of the State.

A bait (*pada*) was killed on the night of May the 6th and I sat upon the machan at 5 p.m. next day. At 7-10 p.m. monkeys began chattering and the tiger appeared at 7-25 p.m. It was bowled over with a shot in the neck before it reached the kill. (Female, 7 ft. 11 in.). I sent a shikari early next morning to see what had happened to the bait and he reported that another tiger had eaten part of it, so I sat up at 6 p.m. and exactly the same performance as on the previous day was repeated, monkeys began chattering at 7-10 p.m. the crackling of twigs announced that the quarry was near, and the tiger appeared from a different direction at 7-25 p.m. and it was bowled over with a shot in the middle of its forehead as it put its head down to the kill. (Male 8 ft. 8 in.). I sent the shikari again early next morning to see the bait and he reported that another tiger had eaten part of it. Things were getting too good to be true, but I took a chance and sat up this time at 6-30 p.m. As soon as the monkeys began chattering at 8 p.m. I was on the *qui vive,* and ten minutes later the tiger showed itself and I tumbled him over with a shot in the same place and in the same manner as the second animal. (Male, 8 ft. 2½ in.). Just for curiosity, I once again sent the shikari early next morning to see the bait and he appeared all smiles to say a fourth animal had eaten practically all of it. As there were fresh pug marks, I sat up but it did not appear which I put down to there being nothing left of the bait.

In all my vast experience of big game shooting, I have never come across such an unique incident, and I wonder whether any person has been fortunate enough to have had such Shikari's luck to bag, three tigers, in three successive days, in three shots, from the same machan, on the same kill, and about the same time.

THE PALACE, PALITANA,
September 23, 1943.

BAHADURSINH,
Thakore Sahib of Palitana.

II.—A BLACK PANTHER SHOT IN SIND.

A fully grown male black panther was shot near Rerhi, a coastal fishing village about 18 miles S.-E. of Karachi, on the 4th April 1939.

Early in April the pi dogs of Bramhyderi, a large fishing village about 9 miles S.-E. of Karachi, began to disappear mysteriously. The villagers thinking that a hyaena was responsible organised a hunt and followed pug marks to a cave in a *nullah* in the low hills near Rerhi. Finding the hyaena, as they thought, 'at home', a *mohana* of Bramhyderi named Suleiman volunteered to enter the cave with a light and a length of rope, a common practice in Sind, to catch the hyaena alive. On entering the cave Suleiman was badly mauled by the animal inside. He was taken to hospital but his wounds turned septic and he died of blood poisoning.

In the meanwhile a strong fishing net was placed over the mouth of the cave and information sent to the police station at Malir, about 6 miles away. On the arrival of the police, some *zamindars* and a horde of men armed to the teeth with guns, spears and clubs the animal was driven out of the cave and shot, speared and clubbed almost to pieces.

The cave contained besides many old bones the remains of a freshly killed pi dog.

The skin of the panther which was secured through the courtesy of Mr. Maqbul Khan, measured 6 feet 8 inches from tip of nose to end of tail, the tail measuring 2 feet 6 inches.

The skin which was seen by Captain Alec Salmon, H.L.I., shortly after it came into my possession in April 1939 is now with H. O. Wood of the Sind Police.

KARACHI,
July 20, 1943.

K. R. EATES,
Indian Police.
F.Z.S., M.B.O.U.

Note.—This, so far as I am aware, is the first record of a black panther occurring in Sind. According to Sind District Gazetteers, 21 panthers have been killed in Sind from 1896 to 1915, and all except 2 of these were killed in Karachi district. Since 1920 several panthers have been shot in the Pabh hills in Las Bela State about 30 miles from Karachi, the last 2 falling to the gun of G. Grosenbacher on the 24-12-36. As pi dogs were disappearing from Mangho Pir, about 10 miles north of Karachi in the direction of the Pabh hills, in March 1939, it is likely that this black panther was responsible and came from the Pabh hills, moving S.-E. through broken country to Rerhi where it was killed as related above. The occurrence of a black panther in Sind or even in the Pabh hills, where conditions in no way favour melanism, is most remarkable and indeed a rarity.

K. R. E.

III.—ON THE OCCURRENCE OF THE YELLOW-HEADED FANTAIL WARBLER (*CISTICOLA EXILIS TYTLERI* JERDON) IN THE KUMAON TARAI, U.P.

The distribution of this species is given by Stuart Baker (*Nidif. Ind. Birds, ii,* 378) as 'from the Bhutan Dooars to Eastern Assam, Bengal, Manipur, Lushai, Chin and Kachin Hills to Yunnan from the foothills and plains up to about 2,500 feet.'

Lalkua (Kumaon district) is a junction in two senses: it is a railway junction 14 miles from the well-known rail-head of

Kathgodam; and it is close to the junction of those two ecologically very different types of country, the Bhabar and the Tarai. The Tarai here consists of high grass with a few Semal trees (*Bombax malabaricum*) dotted about, and occasional clumps of high forest. Two miles along the Forest Department road to Dauli, and just on the northern fringe of the Tarai, is an open grassy space about 400 yards long by 200 yards wide; it is separated from the road by a strip of forest about 50 yards wide, and on the western and southern sides also is bounded by high forest, but to the east the ground falls away down a bank to the open park-like Shisham (*Dalbergia sissoo*) forest fringing the Gola river. The altitude is about 700 feet above sea level, and the map co-ordinates Lat. 29° 03 ft. N. Long. 79° 33 ft. E.

It is a quiet and peaceful spot, this grassy *chaor.*[1] The grass grows to a height of about 8 ft. during the rains, and then is gradually burnt back by a succession of fires that sweep through the area in the hot weather, the last of them as late as the end of May, or early June; the first showers bring up the young grass amongst the dead and blackened stems of the previous year. On this fresh green growth the cheetal love to graze, and there one may watch them of an evening and listen to the hoarse wheezy mating call of the stags in the surrounding forest.

It was while watching some cheetal that a peculiar note, unknown to me, attracted my attention: a soft churr followed after a short interval by a musical or fluty bell-like note, exactly as described by Stuart Baker (*Nidif. Ind. Birds ii,* 379) except that I could not detect any ventriloquial quality in it. To my ear it was quite obvious that both notes were made by the same bird: a tiny bird perched on a dead grass-stem; the whole head and under-parts appeared buff or bleached straw-colour, closely matched by the colour of the dead grass stem, except for a buffy-brown half collar on the nape and sides of the neck; the upper-parts were streaked brown and the short tail blackish. Then the bird took flight and I knew at once what it was, though I had never seen it before. To explain how this came about a short digression may perhaps be permitted.

Oates (*Birds of Burmah i,* 118) wrote 'The Golden-headed Fantail-Warbler' (*Cisticola exilis equicaudata* Stuart Baker) 'occurs plentifully in the plain lying near the Pegu Canal and also along the embankment running from Myetkyo to the Tunghoo Road. It is not universally distributed over the plain, but occurs in a few places only'. No ornithologist has found it since in the above area, though Mackenzie is said to have found it breeding in the Prome district (*Nidif. Ind. Birds ii,* 381). Stanford, who worked the Sittang plain, did not meet with it; H. C. Smith and I spent some days at Myitkyo (=Myetkyo) in early July 1941, and though we searched the banks of the Pegu Canal right down to Waw, and also the embankment running to the Toungoo road, we failed to discover a single bird. Much of the area that was high grass in Oates's day has long since been converted into paddy fields, and we concluded that *C. e. equicaudata* no longer occurs in its old haunts (whereas we were able to prove that *Chrysomma a. altirostris* Jerdon, another species found by Oates in the same area and not since recorded, is still to be found in some grassy swamps north of Myitkyo). Although our hunt for *exilis* proved unsuccessful we had learnt by heart the description of this bird and its musical note; and here was this elusive species cropping up where it had no right to be at all, hundreds of miles from its nearest known haunt, the Bhutan Duars!

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[1] Local term for an open area of grass in the forest.

I was much puzzled by the pale and bleached appearance of the bird, very different from the yellow bird depicted in the plate given in vol. ii of the *F.B.I.* I first saw it on the 30th May, and thought perhaps it was moulting and would turn yellow a week or two later; but when I was next able to revisit the *chaor*, on the 8th July, the bird presented exactly the same appearance, so I reluctantly decided I should have to try and obtain a specimen; unfortunately I had nothing but no. 6 shot, and spent an extremely hot 2 hours on the 9th, and again on the 11th, before I eventually succeeded. The two specimens obtained were sent to the B.N.H.S., where the Curator kindly examined them and confirmed the identification as *C. exilis*; in a letter he remarks that to all appearances the birds belong to the race *tytleri*, but as there are only two specimens available in the Bombay Museum for comparison the race can only be properly determined at the British Museum.

There were certainly 3, possibly 4, pairs of birds in the *chaor*, each with a well-defined territory. The male bird would circle over his territory in a characteristic flight. The 'take-off' would be straight, but rising steadily for 50 yards or so, after which the bird commenced to circle, rising steadily to a considerable height: I estimated 150 feet was about the average. At this height he would circle for varying periods, sometimes for 5 minutes or more, until he had had enough or until he saw another bird trespassing over his territory. In either case the descent was most dramatic: an almost vertical nose-dive at astonishing speed, so fast that the eye could scarcely follow him, flattening out when only a few feet above the earth and returning to his perch with swift darting erratic flight. Twice I saw him dive at a trespasser, the first time at a swallow and the second at another *C. exilis*, and chase him out of the territory, twisting and turning with great rapidity, after which he rose again to continue his flight. Normally however he dropped back to the grass, sometimes down out of sight but at other times alighting on a conspicuous perch.

Throughout the flight the male utters his characteristic note, a wheeze or nasal bleat followed after a momentary interval by a musical note with a noticeable 'r' or roll in it; the nasal bleat is sometimes monosyllabic, at other times bi-syllabic with a drop in pitch. During the take-off, and again when he has made up his mind to descend, a series of short staccato nasal bleats on a monotone is uttered. The soft churr followed by the musical note uttered from a perch is, I think, an alarm note: a warning to the female to leave the nest.

This flight of the male may be a display flight, but my impression was that its main function was to enable him to protect his territory.

My observations did not extend over a sufficient period to give reliable data as to the frequency of the flight, but I noted (*a*) that there was nearly always at least one bird out of the 3 or 4 on the wing, and that a bird seemed to rest for about 10 minutes between flights if not disturbed (*b*) that the flight is carried out both morning and evening, and probably throughout the day (I visited the *chaor* from 9 to 11 a.m. and from 5 to 8 p.m.).

By good fortune there were 1 or 2 pairs of *Cisticola juncidis* breeding in the same *chaor*, so that I was able to compare the flights and songs of the two species.

The songs are of course entirely different, that of *juncidis* being merely a series of sharp clicks, and no one who has once heard both could possibly confuse the two. The display flights are also noticeably different, though the authorities content themselves with saying that they are much the same; in actual fact the display flight of *exilis* is faster, smoother (not nearly so jerky and undulating), and the circling is done at a considerably greater height. Also it is generally much more sustained: or so I thought, staring up at a small speck in a blazing sky for what seemed an eternity, to mark where the bird eventually came to earth. The flight-action of *exilis* consists of a series of very rapid wing-beats followed by a period with wings closed, giving rise to a gentle undulation.

The female I saw but seldom. As Stuart Baker writes (*Nidif. Ind. Birds ii,* 380) she usually gets up, flies straight and low for 50 yards or so, and drops back into the grass; but I did on one occasion see the female rise up to the male in the course of his display flight and after they had flown side by side for a short period, both uttering the characteristic note, they both dropped back to the grass close by, where I shot the female after missing the male (I assume it was a female, but the specimen was too badly damaged to be sexed).

It would round off this account to describe the finding of a nest but in this I failed. By the 11th July the grass was dense and 5 ft. high, and it might have taken days to track down a nest; that the birds were breeding there can be little doubt.

In the first week of August I saw and heard several birds calling over the high grass east of Kichha station, about 10 miles south of Lalkua, in an area I had worked carefully in the cold weather without seeing *exilis*. It may therefore be a summer immigrant from further east; people seldom visit the Tarai (notorious for its malaria) in the rains, which would account for this species having been overlooked in this area in the past. I suspect that it is local but widely distributed in the Tarai during the rains.

Another interesting species breeding in the *chaor* is the Eastern Moustached Sedge Warbler (*Lusciniola melanopogon mimica* Madarász). According to Stuart Baker many specimens have been obtained from Etawah, but there seems to be no record of its breeding in the U.P. I saw only one bird, but from the way it fussed round me with a grub in its bill it obviously had a nest-full of young closeby. As it worked round me in a quarter circle at a distance of about 10 yards, scolding gently the while I had excellent views with glasses at different angles in a good light, and although I had never previously seen this species I had no difficulty in identifying it as the Sedge Warbler from its distinctive colouration. There were several reed-like clumps of grass nearby, and if I had had the time to search I believe the nest would have been found in one of them.

C/o Imperial Bank of India,
Naini Tal,
August 8, 1943.

B. E. SMYTHIES,
Burma Forest Service.

IV.—OCCURRENCE OF THE GOLDEN ORIOLE AND COMMON CUCKOO IN SIND.

Both the Indian Golden Oriole and the Common Cuckoo occur in Sind at the time of seasonal migrations.

As they rarely come under observation, may I add the following to the few existing records.

1. Indian Golden Oriole (*Oriolus oriolus kundoo*) ♂ seen at Jamesabad, Thar and Parkar District, on 16-4-43.
2. Common Cuckoo (*Cuculus canorus* ssp.) specimen obtained at Samaro, Thar and Parkar District on 13-4-43 ♂ Wing 225 mm.

Karachi,
June 5, 1943.

N. H. MENESSE, I.S.E.,
Superintending Engineer,
Eastern Sind Circle.

V.—THE DISTRIBUTION OF THE GREY HORNBILL (*TOCKUS BIROSTRIS*) AND TICKELL'S FLOWER-PECKER (*PIPRISOMA AGILE*?).

Both Whistler and Salim Ali in their books quote that the Grey Hornbill is absent from the Punjab. Here in Sialkot I have seen a party of 6 on several occasions. The birds are very fond of a peepal, which has four bees' nests suspended from its boughs, and also of a species of fig tree in the Kashmir Residency Garden in which a pair nested. The tree had two holes of sizable proportions for the hornbill, the bigger and better hole was occupied by a couple of mynahs. Try as they would, the pair of hornbills could not oust the mynahs from the possession of their home. Eventually the hornbills gave up and became quite content with the second best hole. I left Sialkot while the hornbills were nesting.

Again, in both of the books of the above-quoted authors, I find that they exclude this part of the Punjab in their distribution paragraph of Tickell's Flower-pecker. I have been watching these birds through my glasses for some time and they conform to Whistler's description in every degree. Salim Ali's book shows a Thick-billed Flower-pecker and the birds here are not like it, not having that thick bill. Whenever I approach to get a closer view the bird, which is purely arboreal, becomes shy and flies to the far side of the tree. Being a very active little bird I find it extremely difficult to watch. One pair has built a nest 5 feet from the ground; and the female I have frequently seen sitting on the eggs looking out through the entrance. I put forward the suggestion that the Canal which passes close to Sialkot may be responsible for attracting the birds to this part of the Punjab, as the country round here is not so dry as it used to be.

12TH FRONTIER FORCE REGT., R. G. HUTCHINSON,
SIALKOT, *Captain.*
PUNJAB,
May 28, 1943.

[According to the *Popular Handbook* the Grey Hornbill (*Tockus birostris*) is absent from the Northern and Western Punjab. The species, however, occurs in the more easterly and better wooded districts of the Province. Whistler himself records it from Ludhiana and Ambala in his papers on the birds of these districts published in our *Journal.* Salim Ali's statement that it is entirely absent from the Punjab requires modification. The same applies to the Tickell's Flower-pecker which normally is absent from the drier areas of the Northern and Western Punjab, but occurs in the more easterly districts particularly those contiguous with the Himalayan foot hills. From the author's remarks it is not certain if *P. agile* is the species referred to.—EDS.]

VI.—THE EUROPEAN COMMON PARTRIDGE (*PERDIX PERDIX*) IN PERSIA.

Some time ago I sent you the skin of a European Common Partridge obtained by Capt. G. L. Sawdaz in Persia last year and in confirming the identification, you asked for further particulars as regards the locality where the specimen was procured. In this connection Capt. Sawdaz now writes as follows:—

'I was then at a place in Kurdistan variously called Senandaj, Sinneh and Senna. In the map in the *B.N.H.S. Journal* illustrating the article on Birds of N.-W. Persia it is marked as Senna and appears to be in the Province of Ardelan which is well south of Ajerbaijan, the only locality mentioned in the *B.N.H.S. Journal.* The actual specimen I sent you was shot about 5 miles east of Senna. There were 4 or 5 coveys in some cultivation in a valley. I shot 8 birds myself one day including the one I sent you. At that time I was periodically travelling 100 miles or so along all the roads radiating from Senna and I saw partridges in all directions though never many.

On one occasion I shot one bird out of a good sized covey on top of a 7,000 ft. pass about 80-90 miles west of Senna—well above the Chukor line. Senna itself was about 4,500 ft. to the best of my recollection.

There is no doubt that the Common Partridge is fairly common all over that area, as my observations were mostly made from the road and there must have been many more in the less disturbed places.'

I hope the above further information regarding the occurrence of the Common Partridge in Persia and its distribution will be of interest.

17 STORE ROAD, J. A. CERGH.
BALLYGUNGE,
CALCUTTA,
July 2, 1943.

VII.—DESCRIPTION OF CHICK, IN DOWN, OF THE SIMLA HILL PARTRIDGE (*ARBOROPHILA TORQUEOLA MILLARDI*).

As this stage of the above does not appear to have been described it may not be out of place to describe one which came into my possession this year. It was taken on May 30th when it was not more than a day old.

Description.—A broad band of chestnut base of bill (where it is pinched in near) to the nape where it is 12.5 mm.; a broad buff supercilium extending down the side of the neck. A blackish brown streak from posterior corner of the eye, broadening out over the ear coverts.

Back, to extremity of body, dark brown mottled lightly with red brown.

Side of body, including wing, mottled dark and lighter red brown.

Chin and throat pale buff. A band across breast dark brown mottled with buff and grey which also spreads along the flanks. Abdomen pale buff.

Bill: upper and lower mandibles yellow except across the nostrils where it is horn. Legs and feet dusky yellow. Iris deep reddish brown.

SIMLA, A. E. JONES.
July 28, 1943.

VIII.—LOCAL MOVEMENTS OF THE PAINTED PARTRIDGE *FRANCOLINUS PICTUS*—AROUND BOMBAY.

In the April issue of *Journal* Mr. Humayun Abdulali has asked for notes from other shikaris regarding the scarcity nowadays, of the Painted Partridge around Bombay District. I agree with Mr. Hayes' remarks for in many days spent after this bird in the last three seasons I have found him much more elusive than when I was last shooting in Bombay in 1928, and my best bag has been three couples. However, I have noticed they are obtainable in the bazaar up to the month of May and it would appear that the 'paraphernalia' which Mr. Hayes bumped into around Kardi may after all be the cause of the scarcity of birds.

I would also mention that when I visited a bungalow about a fortnight ago I had the painful experience of seeing 14 partridges in an old fowl house and was told they were being fattened up. There had been 22 and they came in baskets from a district not far away and this in the month of June ! ! !

HORNBY ROAD, BOMBAY, F. C. D. OGDEN.
June 25, 1943.

IX.—BANDING OF LESSER FLORICAN (*SYPHEOTIDES INDICA*) IN BHAVANAGAR STATE, KATHIAWAR.

Although many ornithologists have written a considerable amount about the habits and distribution of the Lesser Florican (*Sypheotides indica*) there is still much more to be learnt about this little bustard, such as, the migration routes and where it goes after leaving its breeding areas. We know that the florican does not go beyond Indian limits and yet we do not know precisely when and where it spreads out, and which route it takes.

With His Highness the Maharajasahib's eager wish to study migration and subsequent factors concerning the lesser florican, I had had the opinion of Mr. S. H. Prater, Curator of the Bombay Natural History Society on this scheme. He promptly agreed to the suggestion and furnished me with rings and data in order to band florican.

Banding or ringing is the scientific method of studying bird migration, age of birds and also habits. This is a hobby which naturalists and sportsmen should undertake and it is my earnest appeal to those who regularly shoot this game bird 'out of season' to make a study of them so that we may obtain adequate data to enable us to learn local migration routes in different parts of the country.

I have so far had the pleasure of banding 100 florican this season with copper rings having a code number B. F. 1 onwards. I shall therefore be glad if any member who may from now on shoot or trap any of these ringed birds will kindly inform me, or the Curator, Bombay Natural History Society. Next year I have a plan to band many more birds with aluminium rings bearing the inscription 'INFORM MAHARAJA BHAVANAGAR B.H.F. 1' onwards. Moreover, I keep a detailed account of each bird banded in a proper Register. I do hope others by seeing what we are doing will take interest and commence banding this interesting bird instead of mercilessly destroying it during the breeding season (May to October). I wish to quote E. C. Stuart Baker who states in *Fauna of British India,* Birds, Vol. vi, page 71 :—'This is one of the Indian Game-birds which requires most rigid protection, as it is constantly shot and harassed during the breeding-season'.

I am grateful to Mr. Prater for having supplied me with the necessary aluminium rings and instructions for banding in the correct way.

BHAVANAGAR, K. S. DHARMAKUMAR SINHJI.
September 4, 1943.

X.—WHIMBREL AND FIDDLER CRABS.

We were watching a flock of whimbrel (Elephanta Island, Bombay Harbour, 10 Jan. 1943) on a mangrove-bordered mud-shore, swarming with fiddler-crabs (*Gelasimus* sp.) of all sizes.

The bird caught the crab by its 'fiddle', lifted it up into the air and then sharply jerked its head. The fiddle broke off, and the whimbrel then methodically dropped the fiddle, picked up the owner and swallowed him ! The place was littered with inedible claws. The size and shape of the whimbrel's beak also appeared to help it to extract the crabs from their holes.

The ease with which the crustacean discards its claws and limbs is often quoted as an adaptive device to help it to escape. In this case the crab is hoisted on its own petard !

FRENCH BRIDGE, BOMBAY 7, M. R. RAUT.
September 15, 1943.

XI.—THE MOULTING OF DUCK AFTER ARRIVAL IN INDIA.

In *J.B.N.H.S.* xlii, p. 444, Mr. Salim Ali has referred to common teal and shoveller being rendered completely flightless due to moult, at Bharatpur, during October.

In X'mas 1933, I was shooting at an irrigation lake in the Nasik District. The quality of the shooting and the scarcity of guns over the huge area resulted in pot shots being taken at young spotbill in the 'flapper' stage. My notes record that a female wigeon, similarly obtained was moulting primaries on both wings and unable to fly. I have shot at the same place (but not before

December) on several occasions subsequently, but have not come across another instance. At Bharatpur this appears to be an annual and regular state of affairs well known to the local people.

BOMBAY, HUMAYUN ABDULALI.
September 15, 1943.

[On p. 365, Vol. xxiii of the Journal Capt. Logan Home recorded a female Shoveller shot at Nowshera, N.W.F.P., with wing quills in moult and unable to fly.—EDS.]

XII.—DUCKS OF KAIRA DISTRICT.

We have been shooting ducks fairly regularly in Kaira district for some thirteen years and have kept notes on our bags. This list of ducks for our locality may be of some interest inasmuch as no previous list has been published for this district.

The waters of this district suitable for ducks consist of several large artificial irrigation tanks. The quantity of water in these tanks is dependent on the annual rainfall, and in some seasons the water is very low. Most of these tanks, even the largest are dry, or practically so for a few months before the rains break. (This is of interest as it would indicate that the ducks indigenous to India, and listed here as occurring in our district must be, at least in part, local migrants; coming into the district to breed, after the monsoon breaks.). Following a good heavy monsoon the duck shooting is excellent; after a light monsoon, the reverse is true. The first of the migrants to arrive are the blue-winged teal, and these in large numbers, sometime in the second week of October. They and the common teal are the last to leave about the middle of March. The average bag consists of blue-winged teal, common teal, and white-eyed pochard in larger numbers; and a fair number of pintail and gadwall.

The following is our list of ducks recorded in Kaira District :—

Nukhta or Comb-Duck (*Sarkidiornis melanotus* Pennant) Fairly common, as long as the tanks are well filled. They disappear later in the season.

Cotton-Teal (*Nettapus coromandelianus* Gmelin)—Rare. Only three recorded; a drake and two ducks shot at Pariaj, Dec. 12, 1942. (The party consisted of eight guns, and the total bag was 121 ducks.).

Grey Lag Goose (*Anser anser* Linn.)—Rare. A flock of six seen at Pariaj, Dec. 30, 1931. Two shot by D.S.P., Kaira, on Jan. 15, 1932, at Pariaj. Three shot at Chitersumba, Dec. 24, 1939.

Lesser Whistling Teal (*Dendrocygna javanica* Horsf.)—Common early in the season as long as tanks are well filled.

Brahminy Duck (*Casarca ferruginea* Pallas)—Not rare. A few to be found along Mahi and Sabarmati rivers and occasionally around the larger tanks.

Mallard (*Anas platyrhyncha* Linn.)—Rare. Only an occasional straggler seen in the district; while they seem to be a bit more common just north of our district in the neighbourhood of Ahmedabad. (Saw a duck and a drake in a large mixed flock of duck on a tank near Ahmedabad, March 20, 1940). Saw a drake and two ducks at Pariaj, Nov. 29, 1941. One duck shot at Gobhlaj, Dec. 24, 1942.

Spotbill (*Anas poecilorhyncha* Forster)—Fairly common. A few to be seen at any time as long as tanks are well filled.

Gadwall (*Chaulelasmus streperus* Linn.)—Common.

Wigeon (*Mareca penelope* Linn.)—Rather rare. A few are seen and shot each season, but never in any numbers.

Common Teal (*Nettion crecca* Linn.)—Common; however, not as plentiful as blue-winged teal.

Pintail (*Dafila acuta* Linn.)—Common. Difficult to shoot as they are the first to rise to a great height and move off to other waters.

Blue-winged Teal (*Querquedula querquedula* Linn.)—Very common—perhaps the most plentiful in the district, with the white-eyed pochard a close second in numbers.

Shoveller (*Spatula clypeata* Linn.)—Common.

Red Crested Pochard (*Netta rufina* Pallas)—Rather rare. Only seen in small numbers in some seasons.

Pochard (*Nyroca ferina* Linn.)—Common.

White-eyed Pochard (*Nyroca rufa* Linn.)—Very common.

NADIAD, HERSCHEL C. ALDRICH, M.D.
KAIRA DISTRICT,
September 20, 1943.

XIII.—THE ARABIAN LARGE-CRESTED SEA TERN (*STERNA BERGII VELOX*) BREEDING OFF THE SIND COAST.

Hitherto the nearest known breeding ground of this magnificent tern has been recorded as Astola, an island off the Mekran coast near Ormara.

For the past three years, if not longer, fairly large colonies of the Arabian Large Crested Sea Tern have been breeding on suitable islands off the Sind coast at the mouth of the Kajhar creek, which lies about 10 miles, as the crow flies, west of the Seer Creek, separating Sind from Kutch.

In May 1934 while looking for favourable flamingo breeding ground I came across numbers of this tern 'packing', a sure sign of breeding, on sand banks near Kajhar creek but it was not till June 1941 that I was able to send out a trusted man, who returned with several very 'high' birds and about a dozen fresh eggs, all that were unbroken out of a basket which contained about 60 eggs. The following year I secured about a score of eggs which were taken on the 14th June and this year I received 64 eggs taken on the 20th June. The man reported that hundreds of birds were breeding and that many eggs were taken yearly for food by *mohanas* from Kutch.

The eggs were laid in mere scrapes in the sand. The nests contained either 1 or 2 eggs, all of which were perfectly fresh. The eggs as a series differ in no way from those taken at Astola off the Mekran coast.

KARACHI,
July 20, 1943.

K. R. EATES,
Indian Police,
F.Z.S., M.B.O.U.

XIV.—THE HATCHING OF A MUGGER (*CROCODILUS PALUSTRIS*).

I am writing to you of a recent unusual experience I had while in company on shikar with Captain I. S. Durrad, also of the staff of this School, as I think it may be of interest.

In May this year we were camped at Devikop forest bungalow about 20 miles from Hubli on the Hubli-Yellapur Road (Kanara). Below the bungalow there was quite a large jhil which does not dry up during the summer. Between the bungalow and the water and about 70 yds. from the water there was a small experimental teak plantation. The Forest Department were working in this plantation putting in teak seeds. One of the coolies engaged on this work was digging when he came across a nest of about 20 crocodile eggs. We opened one and found a fully formed young crocodile which would probably have been born in a few days. As a matter of interest I kept one. On return to Belgaum I put this egg into a cup on a shelf in my sitting room and forgot about it. I had been back here three weeks and was having my breakfast one morning when my bearer came and said there were noises coming from the egg. This was quite correct, and I realised there was a live crocodile in the egg. I then put the egg in a biscuit tin and placed it in a warm place; the noises continued for several days and a very small crack appeared in the shell. When I saw this I took a knife and removed some of the shell. I then put the egg back into the tin and the next morning had a look but it was still in the same condition. I had another look an hour later and the crocodile was born fully formed and full of life. He is now in his natural surroundings.

OFFICERS' TRAINING SCHOOL,
BELGAUM,
June 8, 1943.

C. BONE.
Conductor.

XV.—SPECIFIC IDENTITY OF THE 'RECORD MAHSEER'.

In the April issue of the *Journal* (Vol. xliii, No. 4, pp. 662, 663, 2 pls., 1943), Lt.-Col. R. W. Burton gave some interesting details, with excellent photographs, of two large specimens of Mahseer, 119 lbs. and 110 lbs. in weight respectively. Both were caught in the Mysore State, the larger from the Cauvery River and the other from the Cubbany (Kabani) River. In view of their record size and the interest they are likely to excite among anglers, I propose to deal here with their taxonomic position and assign to them a specific name.

In part xvi of the series of articles on 'The Game Fishes of India', (*Journ., Bom. Nat. Hist. Soc.*, Vol. xliv, pp. 1-8, 1943) I have dealt with the systematic position and geographical distribution of the two species of mahseer described by Sykes (*Trans. Zool. Soc. Lond.*, Vol. ii, pp. 349-378, pls. lx-lxvii, 1941) from the Deccan. Evidence was adduced to show that the high-backed mahseer of the Deccan waters is *Barbus* (*Tor*) *mussullah* Sykes.

Jerdon (*Madras Journ. Lit. Sci.*, Vol. xv, pp. 302-346, 1849) assigned *Kilche* of the Cauvery, a fish that 'grew to an enormous size', to *Barbus megalepis* McClelland, while Thomas (*Rod in India*, 3rd Ed., pp. 22, 23, London: 1897), following the nomenclature suggested by Day (*Fish. India*, p. 573, London: 1878) named his 'Bhwanny Mahseer' or '*Bombin*', a much deeper and more high-backed mahseer than the others, *Barbus tor* (Hamilton). Recent investigations have, however, definitely shown that both these forms are referrable to Sykes's *B. mussullah*. The excellent photographs, reproduced in Col. Burton's article, leave no doubt that his observations deal with the high-backed mahseer of the Deccan, and, therefore, the correct scientific name of the record mahseer is *Barbus* (*Tor*) *mussullah* Sykes. The only other mahseer found in the Deccan and the Peninsular waters is *Barbus* (*Tor*) *khudree* Sykes. The difference in form of the two species is clearly shown in the coloured drawings reproduced with my article referred to above.

1, DEODAR STREET,
BALLYGUNGE, CALCUTTA,
June 18, 1943.

S. L. HORA,
Director of Fisheries, Bengal.

XVI.—STRANGE BREEDING HABITS OF THE CICHLID FISH (*ETROPLUS MACULATUS*).

Although the Cichlid family of fishes is widespread throughout the rivers of Africa and South America, the family is represented in India by only two species, both confined to 'the southern coastal belt. A difficult fish to observe, *Etroplus* does not take well to aquarium life and no *detailed* description of its strange breeding habits has come to the writer's notice.

The writer has been fortunate in that two pairs of *Etroplus maculatus* bred in his aquarium in Poona. On both occasions it was possible to observe the process in every detail. Here are the particulars:—There is a preliminary courtship in which both sexes put on the most gorgeous breeding colours—the body turns a brilliant canary yellow—the anal and ventral fins become deep black. There is a large dark spot centrally situated on the side of the body—the eye turns red and is partially surrounded by a crescent of brilliant iridescent blue.

By nature attractive in shape, with vertically flattened body and perky fins, this fish, male and female is a really striking sight at breeding time. Having put on their wedding garments, the pair proceed to investigate the aquarium for possible enemies—other fish are pushed about and bullied no matter what their size—even the owner is not immune—a finger dipped into the aquarium invariably receives a painful nip—doubtful looking plants, possible hiding places of enemies, are investigated in detail. If suspicious, the fishes just root them up. Finally a clear belt is made round the site selected for spawning. The female now protrudes her ovipositor—rather like a small thorn near the vent. The actual site for spawning—the glass side of the aquarium is carefully picked clear of all impurities—algae and debris. Whilst the male stands guard, the female swims up to the site—she moves up vertically, her ovipositor just touching the glass and ejects a number of eggs—generally two. These eggs are dark in colour, the size of a pin's head *and are attached to the glass by a gelatinous thread approx. 2 mm. long, so that they can move freely in all directions.* Having fixed her eggs, she darts over to the male, who is on sentry-go, and gently nudges him with her snout—he turns and sails over to the spawning site, whilst she takes over the duties of sentry, facing away from her mate and exhibiting every sign of ferocity.

The male having reached the eggs, sails upwards across the site. His body trembles violently as he ejects his milt over each egg in turn. He now returns to sentry duty, whilst the female again ejects a couple more eggs. So the process goes on until approximately 150 eggs are deposited. The site chosen is in the angle of the aquarium, close to the bottom. The eggs, each anchored by an individual thread, resemble a black curtain fringe. The fishes now take it in turn to fan the eggs—For this purpose they use their pectoral fins, moving up and down over the spawning site. Whilst one fans the other does sentry-go, keeping all intruders at bay. The sentry has to be relieved at times and there never seems to be any misunderstanding about this—the fish that fans moves over, nudges its companion and takes over, whilst the releived sentry moves back to fan the eggs. Occasionally fanning is stopped for a few moments, whilst the fish picks some algae off the glass or some debris off the bottom of the tank.

Forty-eight hours after spawning the fishes take it in turn to dig a hole in the aquarium sand. This is done very thoroughly. Quite large pebbles are rolled out—smaller ones are carried by mouth and dropped some distance away. When the hole is dug to their satisfaction, and when it has been thoroughly cleaned, one fish remains on sentry go whilst the other proceeds to the spawning site. The eggs are taken in the mouth, two or three at a time—a gentle pull releases the retaining thread—they are now carried in the mouth to the crater in the sand and gently dropped in. When all have been so transferred, the fish are much happier. The pair find it quite an easy matter to safeguard the young by sitting on top of the hole and fanning. All the time there is a great fussiness about sanitation. Both fish constantly peck about in the sand. If debris is found, it is picked up and spat out in the far corner of the tank. The digging of holes continues daily and the eggs are constantly changed from one site to another. This extreme cleanliness is evidently intended to prevent fungus disease which would, in less clean surroundings, attack and kill the eggs.

By the end of the fourth day a constant waving motion is noticed amongst the eggs—the young are hatched out but are still attached to their yolk sacs. They look just a mass of tiny helpless creatures, scarcely recognisable as fish—the parents keep up their unremitting care, refusing ordinary food. If, however, any live insect, mosquito larvae or the like is introduced into the tank, it is immediately snapped up. They appear, at this stage, to only eat in defence of their young. Another fish of their own size or even bigger, if introduced, will be attacked viciously and killed if not removed. On the eighth day exactly, the young fish start to swim. Early efforts are supervised by the parents, who use their pectoral fins to sweep the babies gently about. Enterprising youngsters are sternly repressed. If one strays from the flock, he is seized in the parent's mouth and brought back to be spat out well into the centre of the crowd.

Each baby fish has its daily bath! This is done by the parents taking individual babies into their mouths. They are rolled round and round inside and then ejected clean as a new pin. Parents keep their young in a compact mass and cruise along the bottom of the aquarium picking at algae and turning over smaller pebbles rather in the way a hen scratches for her chickens. To keep the young alive at this stage is a problem. They must have live animalculae, minute rotifers and the like—these are obtained by sweeping a net of fine bolting cloth in any neighbouring pool—the dirtier the better! Infusoria of this nature when introduced into the aquarium look like minute specks of dust. The young eagerly devour them and grow rapidly. Certain types of animalculae seem to be not good for the children, so are disposed of by the parents. Throughout this period the parents retain their beautiful colours and are most affectionate. One often sees them gently rubbing sides, the nearest they can go to a caress. They appear so proud of their children—so ready to give their lives if necessary in their defence—so keen on cleanliness and the health of the babies—True exponents of infant welfare. Every item set forth above has been seen and noted at the time by the writer. Apart from whatever addition it may make to the knowledge of the breeding habits of our Indian fishes, it has been a delightful experience for the observer.

GANESHKHIND, POONA,
June 1, 1943.

H. J. RICE,
Lt.-Col.
Army Medical Centre.

XVII.—A NOTE ON THE TRANSMISSION OF MALARIA AT KETTI, NILGIRIS, 6,300 feet.

Towards the end of September, 1941, there occurred at St. George's, Ketti, what Dr. Russell, then attached to the Malarial Institute of India, described as 'an unique outbreak of malaria'. Out of the 235 children in the school there were seven cases of malaria (blood smears showing *P. falciparum* 5, *P. vivax* 3, one showing both species).

In early June of 1936 two other cases had occurred among the children and at the same season this year a member of my staff contracted the disease (all blood smears showing *P. vivax*).

In the October epidemic the possibility of relapses must be considered in four cases, as three of the children had originally, but not recently, come from the plains. None of them, however, had been out of Ketti since February, and the fourth child had on one occasion been down to the jungles at Kallar, though only for a short time during the day. The remaining children had been living in Ketti for some years, one of them never having been away from the hills[1], and the rest not having descended below 6,000 ft. during their residence in Ketti.

Regarding the cases of 1936, both the children had lived in Ketti for a considerable period : one had not been below 6,000 feet for several years, but the other may have returned to his home on the plains for the Christmas holidays, so must be considered as a possible relapse. In the case recorded in this year the patient had spent part of January in Madras. Malaria was possibly contracted there as the patient had not been near the streams and marshes mentioned below and also had been well bitten by mosquitoes in Madras, a focal point of infection being the presence in the neighbourhood of evacuees from Burma.

Of these ten undoubted cases of malaria it is evident beyond any reasonable doubt that the disease was transmitted to four at Ketti and in all probability to five of the remaining six.

Furthermore, Dr. K. I. Simon, the Ketti doctor, informs me that he has come across frequent cases of malaria among the Badaga population of the Ketti Valley. Of these numerous cases the possibility of relapses, or of the disease having been contracted elsewhere and having developed in Ketti, can be ruled out in eight instances, as I am assured that these patients never had occasion to leave the Ketti Valley. Blood smears were taken in only four cases but these were all positive for malaria and the remaining cases were all typical and responded to injections and oral administration of quinine.

Details of these eight cases were as follows :—

1940	one case	September.
1941	one case	September.
1942	four cases	April, August, September (2).
1943	two cases	May, August.

---

[1] This case was infected with both *P. vivax* and *P. falciparum*.

The maximum altitude for the transmission of malaria in these hills was hitherto considered to be 4,000 ft., this being a fairly constant boundary: but here is evidence of transmission at, or above, 6,000 ft.

The weather directly preceding the outbreak of 1941 was extremely wet and without high winds, on account of which the density of Anophelines was high. The older children, among whom the outbreak exclusively occurred, had been practising for their annual sports on the sports ground which is situated at the lowest point of the estate adjacent to the junction of two streams which are bordered at some places by marshy ground. The children had been returning from this field at dusk and it seems probable that the infection was contracted then.[1]

Of the eight above-mentioned village cases six were Badagas who lived close to the stream and the swamps.

Shortly after the outbreak of 1941 painstaking collections of *Anopheles* larvae and imagines were made by Dr. Russell and his staff with the following results:—

Species	Larvae.	Adults.
A. aitkeni	43	1
A. culicifacies	nil	1
A. gigas	19	1
A. jeyporensis	9	1
A. maculatus	27	nil
A. splendidus	3	3

All the adults were dissected and found negative.

Owing to unfavourable weather conditions the collections were scanty. *A. culicifacies* is a known carrier on the plains wherever it has sufficient density and is, I believe, a new species at this altitude. *A. fluviatilis,* the common carrier on the ghats, was not observed. None of the others is a known carrier in the Nilgiris, but *A. jeyporensis* has been known to transmit malaria elsewhere.[2]

What then is the cause of this transmission of malaria at an unprecedented altitude? Two solutions are suggested below or a combination of both may solve the problem.

The first is a solution suggested by Dr. Russell.

During 1941 more than 2,000 labourers, many from malarial districts, were imported to Aruvankadu, between two and three miles from Ketti, and it seems possible that with such ample opportunities for infection the local Anophelines may transmit malaria. In this respect it should be noticed that in November of 1941 two cases of malaria were observed among adults in Aruvankadu who had not been out of the village for some years and another case was observed in the neighbouring township of Wellington at 6,000 ft. It is of course quite probable that there have also been other cases in neighbouring villages which have not been reported.

---

[1] Since the introduction of Summer Time there has been no occasion for children to be near the stream at, or after, dusk and no cases of malaria have been recorded among them.

[2] Bainbrigge Fletcher, *Some South Indian Insects,* 1914.

Whether this solution explains the occurrence of numerous cases in the entirely unconnected valley of Ketti is doubtful but it certainly fails to explain the cases previous to 1941.

The Ketti Valley below the school slopes gradually for 2½ miles in a southerly direction to Kateri, whence it enters a valley which descends rapidly to the Bhavani Valley at 1,100 ft. The Bhavani River continues in an E. N. Easterly direction to debouch onto the Mettupalaiyam Plain some 9 miles distant. The whole of the lower region is highly malarial.

It is noticeable that the cases of malaria have occurred just before and just after the S.-W. monsoon season when the main wind currents come from the E. and N.-E. respectively. It seems probable that the wind currents strike the entrance of the Bhavani Valley and ascend that and the Ketti stream, reaching Ketti as a southerly breeze. This is certainly my experience of the lower wind currents at these seasons from observations taken near the head of the valley. Such wind currents would doubtless encourage mosquitoes of low elevation habitat, such as *A. culicifacies*, to ascend the valley. At these times of the year they would find the Ketti Valley favourable to mosquito life as it is particularly protected, warm by day and night, and damp and marshy.

What we may term the 'non-malarious seasons' correspond to the S.-W. monsoon season when strong N.-W. (sic) gales blow somewhat against the direction of the valley, the winter, when the nights are cool, and the warm dry period from mid-February to mid-April.

In support of this theory I may state that I have caught certain varieties of butterflies here at those seasons when the upper wind currents flow from the E. and N.-E. whose appearance at the altitude of Ketti is most unusual. The foodstuff of the larvae of some of these species is not found anywhere nearer than several thousand feet lower than Ketti.[1]

It is worth observing that the flora of Ketti is quite normal for the altitude, but this is easily explained by the rough S.-W. monsoon weather and the cool winters.

In conclusion, malaria would seem to be endemic in the Ketti Valley. Is it not possible that the transmission of malaria occurs as a combined result of favourable lower wind currents up the valley at certain seasons, mild wet weather before and after the monsoon, and the protected nature of the valley? When these conditions are combined to an exceptionally favourable degree, as in September of 1941, may we not expect a minor epidemic?

KETTI, NILGIRIS, M. A. WYNTER-BLYTH,
September 10, 1943. M.A. (*Cantab*)

---

[1] I have observed the following species of butterflies at Ketti whose appearance at this altitude is most unusual.

Bindahara phocides moorei : March.
Byblia ilithyia : September.
Charana jalindra macarita : early June.
Nacaduba dana dana : April.
Leptosia nina nina : February.

I have observed no unusual species during the S.-W. monsoon.

XVIII.—BUTTERFLY MIGRATION.

(*DANAIS MELISSA DRAVIDARUM* AND *EUPLOEA C. CORE*)

During a trip I noted many interesting things new to me, on one of them I would like further information. Perhaps you can help me. It concerns butterflies. In early July I watched a migration of butterflies for eight days, a continuous stream passing at the rate of thousands a minute, all heading west, and stretching, to my knowledge, ten miles on either side of Kolar town. In sheltered places they hung on bushes in such numbers as to weigh the branches down. They were all of two varieties, one black with pale blue spots, the other sooty black with white spots on the edge of the wings and both had a wing span of about three inches. Have I seen something unusual or is this a common happening in this area.

July 20, 1943.

Your letter and Journal have arrived for which many thanks. What a pity I was not aware you wanted details and specimens of butterfly migrations. I took very few notes at the time and could easily have sent you ten thousand specimens. I cannot add much to the details I have already given you. The exact dates were July 5th to 12th and the flight was in progress when I arrived in the district and ended on the 12th. I was able to observe them the whole time as I was driving a car backwards and forwards every day over the 20 miles. The flight never ceased during day light but I did not see one on the move after dark. There was a strong S.-W. breeze blowing the whole time with occasional heavy showers and they were flying into the wind between ground level and 12 ft. The two species were in about equal numbers. Under the trees and bushes where they were resting, the ground was littered with wings, never a complete specimen, just single wings. Had something been feeding on them? I did not take any specimens from the flight but am enclosing one of each species which I caught in Bangalore today. From the illustrations in the Journal I should say that they are *D. septentrionis* and *Euploea core*. A friend has told me today of driving for about six miles through a flight of the same two species about 40 miles east of Kolar on the Madras road on May 5th this year.

NO. 1 COY. 3RD I.A.F. SIGNALS, W. L. FRENCH.
September 9, 1943.

[The specimens received were identified as *Danais melissa dravidarum* Frnh. and *Euploea core core* Cr.—Eds.]

XIX.—INSECTS IN FRUIT EATEN BY BIRDS

Comment on the supposed frugivorous habits of Woodpeckers.

On page 122 of the August number of the *Journal* is a record of woodpeckers eating berries on trees with an editorial note remarking that a frugivorous diet is unusual in these birds. It is possible that the individuals observed *were* essentially insectivorous for the berries may have contained insect larvae. Further observations would be interesting.

The fruits of some trees are very badly attacked especially by weevils. Some years ago my small son, in Mussoorie, discovered a tree of *Machilus duthiei,* with a great number of berries, all of which, so far as we could find, were attacked by *Drepanoscelus gardneri* Mshl., a weevil with a very peculiar looking larva indeed. Incidentally there is a great deal that is unknown about insects in fruits and seeds of forest trees and I should appreciate samples sent to my address.

FOREST RESEARCH INSTITUTE,
DEHRA DUN,
September 22, 1943.

J. C. M. GARDNER,
Forest Entomologist.

XX.—A TRIP TO THE YALA SANCTUARY.

On September 17th I started from Colombo at 6-30 a.m. with Major M for Yala Sanctuary—180 miles away on South East Coast. We went in M's Ford 8, loaded with kit and with petrol (for which coupons were obtained with difficulty) and arrived at Tissamaharama at about 3-30 p.m. and filmed a small crocodile in the huge tank there. Shortly before Tengalle we passed into the 'dry zone' where the country changed completely into thorn scrub exactly like Coimbatore with rocky bare hills like Mysore. There were many ibis, spoon-bill, cormorants and divers on the tanks. We arrived at 5 p.m., over a rough jungle track at Palatupana where the Sanctuary Warden lives. This is outside the sanctuary. I went out with M and the local Excise Commissioner to watch for elephants coming to drink in the tank behind the bungalow. Just before sunset a three-quarter-grown bull elephant arrived and walked over the bund to drink. I walked up to 25 yards and exposed 20 feet of film before he became suspicious, remounted the bund and after standing there for some time while I filmed him at close quarters decided to make off into the jungle.

On the 18th we motored another 12 miles over a very rough sandy track between almost impenetrable thorn jungle, with the sea behind and jungle covered sand dunes on the right. The next land is the South Pole! The only difference between the Sanctuary and the surrounding jungle is a reinforced concrete notice board pulled to pieces by elephants. This could probably be remedied by a black notice board. It was hot and dry with a strong wind blowing. We saw several wild buffaloes in a wide tank and some wild pig on the shore. I crawled up to the latter through a thorn jungle to 20 yards and took several feet of film, and afterwards made some long range movies at one of the buffalo bulls who seemed undecided whether to charge or not. After this the Sinhalese tracker advised sitting in a hide of a few branches by a half dry jungle pond. A small family of spotted deer came down and drank while 2 or 3 wild buffaloes crashed away out of the mud as we approached the pond. After going another 4 miles we stopped at another jungle pond where I sat behind a few branches under a thorn tree while M and the tracker took the car on to Yala bungalow. While I was still breaking small loop holes for the camera in the screen of branches, I heard a rush over the dry leaves and a crash behind me and the next moment a fine panther descended on my water proof coat spread out beside me, so near that I could have touched him with my hand. He gave one grunt before I could move and vanished to the right in a couple of heavy bounds. I could see as he went that he was one of the big, forest type of panther with a beautifully marked skin. It appeared to me that he had heard me breaking the twigs, had seen the top of my topee and had mistaken me for a new type of deer. He had rushed me from about 15 feet and had presumably realised at the last moment that I was a man, and so had swerved off.

After half an hour 2 bull buffaloes arrived and drank and the bigger bull wallowed. I took 25 feet of film at 50 yards. After another half hour a small sounder of wild pig arrived, one with a litter of tiny squeakers. These were trying to take 'tea' while their mother was in the water. She was very patient with them. The pig drank and wallowed and later a young bull buffalo arrived and was filmed and at about 5 p.m., a sambhur stag (horns about 32 inches) drank and wallowed about 20 yards away. He was duly filmed also as he stood on his hind legs to eat berries of a tree. I walked back to camp about 6 p.m.

On September 19th we went up the Menik Ganga (River of Gems) for two or three miles through grand jungle reminiscent of the Wynaad. We made a hide of branches under a shady tree and filmed buffalo and pig which came within 20 yards at times to drink and wallow in the river running in shallow streams through sand and rocks. After a few hours we shifted our hide upstream and threw a few branches together under a tree, whence I issued to film spotted deer—a small herd at close quarters—and to stalk a boar in his wallow at 30 feet. A small herd of buffaloes came and settled down in the water within 30 yards. After half an hour the wind changed and they advanced snorting on the hide, while I filmed them up to 15 yards away. Finally they crashed off. There are literally hundreds of wild buffalo on this river, some of them remarkably fine bulls with thick curving horns who stand and glare and snort before crashing away to the jungle from their pools in the river. They are supposed to be dangerous but we never had a charge, though at times one seemed imminent. They make less noise than bison when galloping away into the jungle. A wild sow was seen in the distance with a family of 5 tiny striped squeakers not more than 8 inches high following her through water and over sand banks in a compact little mob. About 4 p.m. we started slowly back and after half a mile walked right into a fine bull elephant drinking below the bank. I walked up to 15 yards, so close that I could only film him in sections, as his head alone more than filled the view finder. Finally he got our wind and turned and shuffled off to the forest on the opposite bank at a great pace.

Afterwards we saw at least 20 baby crocodiles all less than a foot long, pouring in a mob off a fallen tree into a pool and diving down to holes in the banks below water. Shortly after I stalked a small crocodile about 8 feet long to within 15 yards and filmed him before he slipped into the water. The trees in the heavy jungle along the banks are magnificent, huge trunks 8 or 10 feet in diameter in some cases.

On September 20th we went again up the Menik Ganga but saw very little, the day being over cast after rain in the night. Several small crocodiles slid into the water and I eventually stalked one to about 40 yards and filmed him. I now have only 10 feet of film left out of 250 feet. The trees on the river are alive with hornbills, the large kind with the upper casque on the bill, paradise flycatchers, kingfishers (both the common and the white-breasted) and all kinds of small song birds besides parroquets. We bathed in the evening in a pool of the river below the bungalow keeping a watch for crocodiles of which there are several big ones in the river. Last night we heared elephants trumpeting and screaming in the forest on the far bank and two wild buffaloes walked past the bungalow within 5 yards of our camp beds, as we found by their tracks this morning.

On September 21st we went back to Polatupana and on the way visited the 'Panther Pond', Rukinawala, with M, the warden and his head tracker. As we approached there were five buffaloes and several wild pig in the water and pea fowl and a herd of spotted deer on the shore, all drinking together. After seeing the panther's tracks the warden's opinion was that the panther had lain watching me at a few feet range for some time and then had deliberately attacked, but was put off by a thick thorn bough at my back, and being disconcerted by this had failed actually to strike me and had made off. This is just possible from my own knowledge of tigers and panthers, but the incident is interesting as an actual experience of how a panther stalks and rushes a deer.

On arrival at 'P' we went down to the end of the lagoon with the tracker and motor driver, where there is a big sand bar with boulders and the surf on the far side, and caugth some crabs for dinner. I noticed tracks of deer in the sand along the shore.

After returning to the rest hut a Buddhist Votary, under a vow to live in the jungle, came past and we called him in and asked him about his life. He was very simple and cheerful and asked for nothing. He apparently lives among the animals and says that in the rains if he lights a fire before a cave where he shelters, the bears come up and sleep on the far side. He has apparently wandered all over Ceylon. He was very grateful for some cheroots which he said were as good to him as food.

I picked up a small Star-shell Tortoise to take back to Colombo as a pet. Later in the evening I went to try for another picture of elephants at the tank but nothing came before dark, though later in the night several elephants were trumpeting and roaring in the water close to the hut. It is noticeable that Ceylon elephants appear much shyer than those in S. India. This may be due to the large number shot as alleged 'rogues'—I have heard of residents shooting 20 or 30 elephants—all, or nearly all, tuskless.

On September 22nd we started back at dawn and came without incident out of the dry zone to Tangalle where I filmed hawks bill turtles (from which tortoise shell comes) swimming in the clear blue water up to the beach below the rest house. M got a man to pull several lumps of white and pink brain coral off the reef for me. We got back to Colombo safely at 5 p.m.

BASE P.O.,
COLOMBO,
May 26, 1943.

H. G. ROSSEL,
Lt.-Col.

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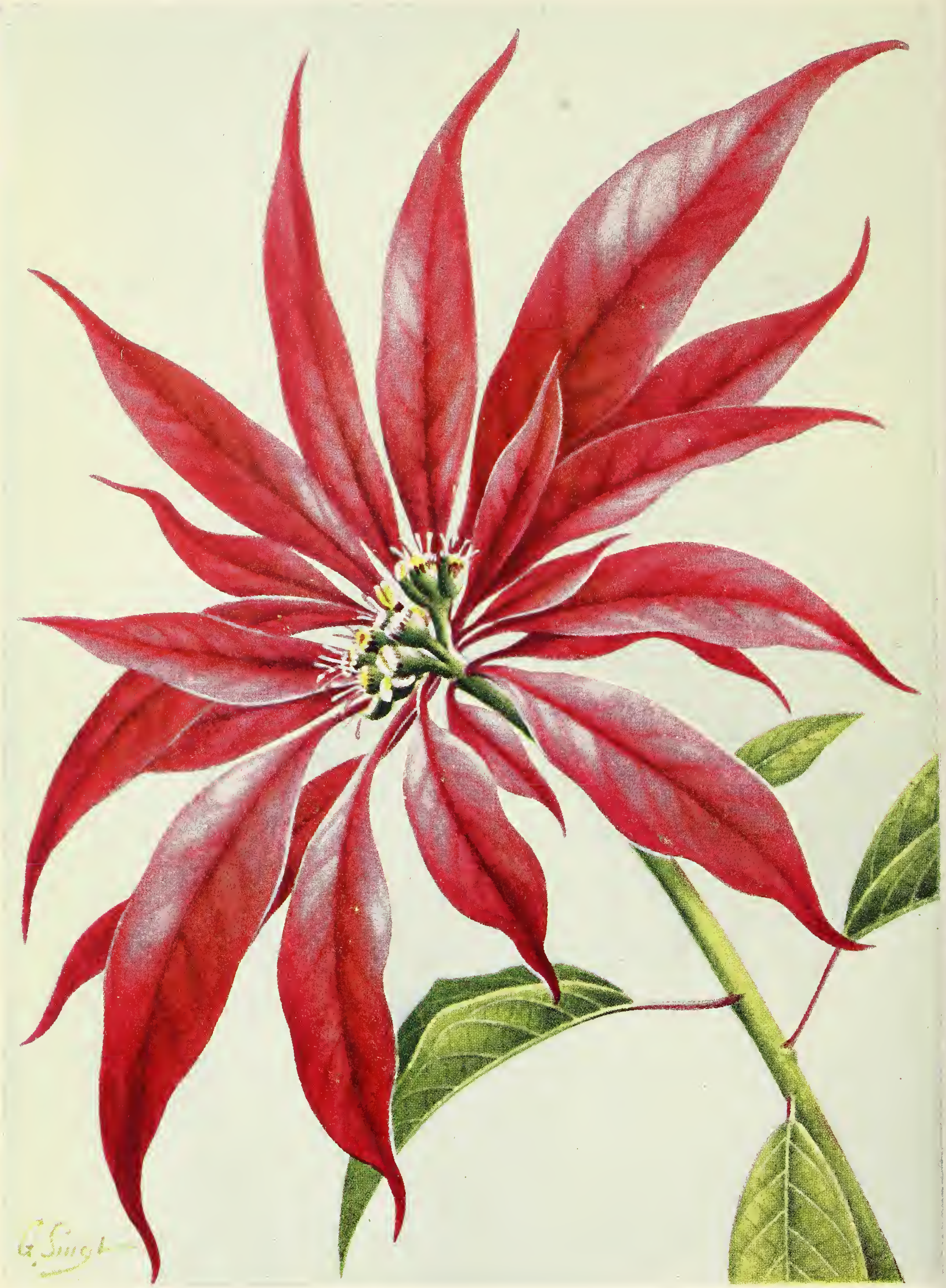

The Christmas Flower

POINSETTIA PULCHERRIMA Grah.

($\frac{7}{8}$ nat. size).

TO MEMBERS

It is regretted that owing to present-day conditions there has been unavoidable delay in publishing this Journal. Every effort is being made to maintain the standard of the Journal and to issue it to members as regularly as possible.

The Index to Vol. XLIII, Nos. 3 and 4, has been lost at sea and will be published later.

EDITORS

JOURNAL

OF THE

Bombay Natural History Society.

1944. Vol. XLIV No. 3.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS

BY

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AND

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Part XVI

(*Continued from Vol.* xliv, *No.* 2 (1943), p. 163).

(*With* 1 *coloured and* 3 *black and white plates and* 3 *text-figures*).

Euphorbiaceae.

Pliny relates in his Natural History how this family got its name. It appears that the medicinal plant, now known as *Euphorbia officinarum,* was called *euphorbea* by King Juba of Numidia, in honour of his favourite court physician Euphorbus.

This enormous family, which contains about 200 genera and more than 4,500 species, extends over the whole of the surface of the earth with the exception of the arctic regions. The characters of the family are as follows :—

The family includes large and small trees, undershrubs and herbs. Some species are succulent and resemble the genus *Cereus* of the *Cactaceae.* The juice is often milky, opaline or watery, sometimes acrid. The leaves are alternate, rarely opposite and whorled, petioled or sessile, nearly always simple, rarely trifoliate or pinnate, entire,

SEP 25 '44

toothed, lobed, varying considerably in shape, texture and indumentum. Inflorescence various, usually made up of unisexual flowers, often very inconspicuous, gathered into heads or profusely paniculate. Calyx of valvate or imbricate sepals are completely absent. Petals absent or rarely present and sometimes united (*Jatropha*). Stamens 1-1,000; filaments free or connate. Anthers 2-celled, sometimes 3-4 celled, erect or inflexed in the bud, opening lengthwise by slits rarely by pores; rudimentary ovary usually present in the male flowers. Ovary superior, mostly 3-celled, styles free or united at the base, often again divided and papillose above; ovules solitary or paired in each cell, pendulous from a funicle which is often enlarged. Disk usually present, circular or of separate glands. Fruit a capsule or drupe. Seeds often decorated with a fleshy appendage called a caruncle.

The family is remarkable for a peculiar type of inflorescence called a cyathium which is often, and quite pardonably, mistaken by students for a single flower. In its typical form it consists of an envelope containing inside a number of stamens and a stalked 3-celled ovary. If each stamen is examined carefully with a lens it will be seen that it consists of a short stalk upon which is joined a filament carrying the anther cells. This structure is to be regarded as a single flower consisting of a single stamen seated upon a pedicel. Calyx and corolla are entirely absent.

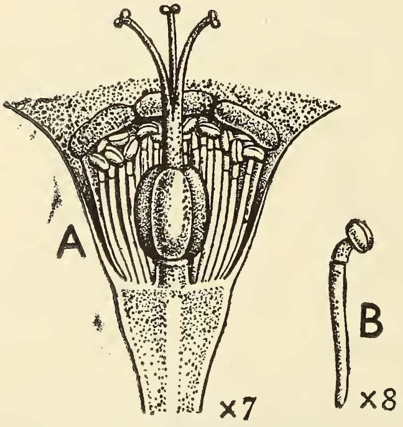

Fig. 1.—*A*. Inflorescence of *E. Bojeri*. A typical cyathium showing one female flower surrounded by many male flowers. *B*. A male flower, consisting of a filament with anthers, seated upon a pedicel; there is no floral envelope.

At the micropyle end of the ovary is to be found a fleshy growth called the obturator, another peculiarity of this family. The obturator is a placental outgrowth whose purpose is to assist in conducting and to nourish the pollen tube. It disappears after fertilisation.

Fertilisation is believed to take place mainly through the agency of Diptera, but there is little doubt that many other insects assist in the process. Some plants are anemophilous; but those that possess nectaries and coloured floral bracts are certainly adapted for cross-fertilisation.

As already stated this family has representatives over almost the whole of the surface of the earth, but it reaches its greatest luxuriance in the tropics. In the evergreen forests the members of the family occur as lofty trees, shrubs and climbers. In the drier parts of the tropics they occur as out-and-out xeromorphs, resembling some cacti in form. A number of species of *Euphorbia* belong to the latter class and anybody who is familiar with the drier parts of India will remember the arborescent forms of this genus, which are so conspicuous on the arid foothills of the Punjab and United Provinces and in other parts of Central and North-western India. These species of *Euphorbia,* with their prickly fleshy stems full of a white milky juice, are favourite hedge-plants in the more arid parts of India. Their prickly stems and branches protect them from sheep, cattle and camels, and in heavily grazed areas they are often the only vegetation left upon the ground; so that in certain parts of India they come to form a characteristic community of vegetation. *Euphorbia antiquorum*, a leafless thorny representative of this class, which is found all over India is known as '*Maharrik sha*' in Sanskrit, and is mentioned in the Old Testament.

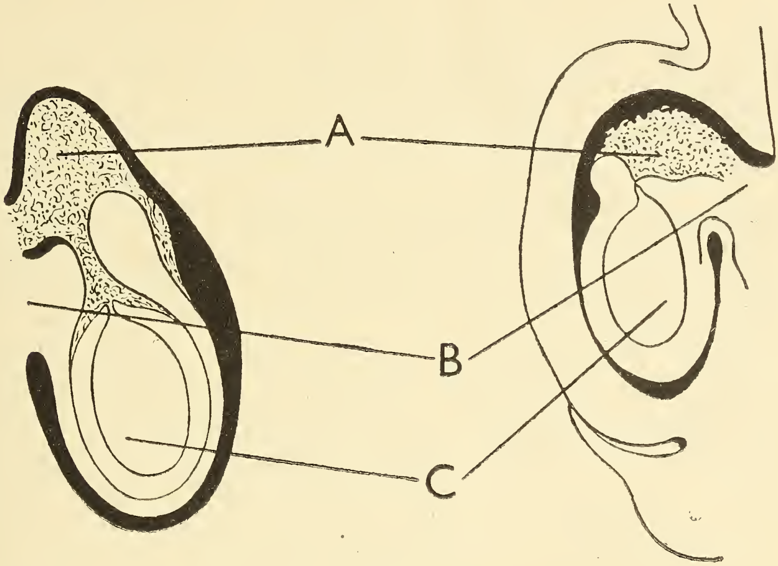

Fig. 2.

Longitudinal section of the ovaries of two species of Euphorbiaceae showing:
A. —obturator.
B. —placenta.
C. —ovule.

The obturator is an outgrowth of the placenta and serves to guide the pollen tube to the micropyle.

Euphorbiaceous plants are the source of numerous substances and raw materials without which it is difficult to imagine life as we know it today. In the first place comes natural rubber which is obtained almost exclusively at the present time from the South American tree *Hevea brasiliensis*. The 'Para' rubber of commerce is that produced from this tree and it forms about 85 per cent of the world's trade in this substance. Another tree of importance in this respect is *Manihot glaziovii* which is the source of Pernambuco or 'Ceara' rubber.

A close relation of the last named species is the Cassava or Tapioca tree, *Manihot utilissima*, which is of great importance in South America, its home, in parts of Africa, and in the Naga Hills, Assam on account of the swollen roots which contain a large quantity of starch. The remarkable fact about the swellings is that they contain sufficient hydrocyanic acid to render them extremely poisonous. This poison is liberated by the action of an enzyme on a glucoside, phaseolunatin, particularly when wilting occurs. Thus a fresh root which is free from hydrocyanic acid may become deadly poisonous if allowed to become stale. When a tuber is boiled the enzyme is destroyed and the hydrocyanic acid being soluble in water is carried away. As the acid is found chiefly in the cortical layer, peeling the tubers removes the danger of poisoning to a large extent.

Another plant of importance is the tree *Emblica officinalis*, the myrabolan tree. The fruit of this tree is much used in India where the juice of the fruit is taken internally for dyspepsia, dysentery and as a diuretic. It is used externally for conjunctivitis. Recently it has been discovered that the fruits of this tree are very rich in Vitamin C.

Castor oil is obtained from *Ricinus communis*, another member of the family. It is believed that its native home is in Africa but it is cultivated for its oil in all the warmer parts of the earth. Besides the oil the castor oil seeds contain a very poisonous substance which is called ricin. Ricin is the substance which causes death when the seeds are eaten, its action being that of a coagulant in the blood. It is known that death has followed the eating of four seeds. The German chemist, Ehrlich, discovered an interesting fact about this poison. When ricin is introduced into the blood stream an antitoxin (antiricin) is produced in the blood, so that the body can acquire a certain immunity towards the poison. It is now known that several other substances as well as the bacterial toxins act in the same way. Fowls appear to be uneffected by the poison and horses can consume considerable quantities of it. Castor oil is used (apart from its use as a purgative) as an illuminant and as a lubricant for aero engines where its viscosity and low freezing point render it particularly valuable.

Several other species contain poisonous elements in the seed or latex. *Excoecaria agallocha*, a seashore shrub or small tree, contains a substance in the juice which can blister the skin and has been known to cause blindness. The most poisonous of them all is said to be the 'machineel' tree, *Hippomane mancinella*, which is a tall tree of Tropical America. As was the case in other poisonous trees, this particular species was credited with the most extravagant properties by early explorers of the nineteenth century. For example, to sleep in its shade meant death, and even to go near it was certain to cause erysipelas if nothing worse. All these fables were disproved by one brave soul, J. Jacquin, who stood naked under the tree for several hours and took no harm.

A number of species of the *Euphorbiaceae* are cultivated in gardens, either for the striking colour of the floral bracts or for their variegated or handsome foliage.

Key to the Genera

Flowers contained in a bowl-shaped structure: no calyx or corolla.	... 1. *Euphorbia.*
Flowers with a distinct calyx and conspicuous red corolla.	... 2. *Jatropha.*

PART I

1. **Euphorbia** Linn.

A very large genus, the majority of the species of which are herbs, but there are a few shrubs, some of which are grown in gardens. All species possess a copious milky juice. The leaves are alternate, opposite or verticillate, stipulate; stipules often glandular or spiny. Inflorescence of cyathia which are entirely male or sometimes dioecious. The involucre is cupular or campanulate, often provided with nectar-secreting glands, and containing the closely packed male flowers, each consisting of an antheriferous filament jointed on a pedicel. Interspersed are a number of sterile pedicels usually lacerate or hairy. The stamens are 4-30 or even more in number. The anthers are two in number, 1-celled, one on either side of the tip of the filament, at first depressed, eventually erect at dehiscence. Female flowers seated on a pedicel, naked, 3-lobed, 3-celled; one ovule in each cell; ovules pendulous; styles three in number, connate or not, dividing above, into two stigmatiferous arms. Fruit a capsule consisting of three cocci.

Key to the Species.

Stem spiny and prostrate: flowers without long red bracts.	... *E. Bojeri.*
Stem spineless, erect; flowers supported by long red, pink or white bracts.	... *E. pulcherrima* (Poinsettia)

Euphorbia Bojeri Hook.

Crown of Thorns.

(named in honour of Wenzel Bojer, 1800-1856, an Austrian botanist who wrote a flora of Mauritius).

Description.—A low sprawling shrub with long-spined, livid-coloured, fleshy branches and small leaves. Spines on the branches in pairs up to 1 in. long or more, very sharp. In between each pair of thorns is a reduced branch which bears pairs of small spines 1/8 in. long. In between each pair of small spines a leaf is developed. The spines may therefore be regarded as stipules. The leaves vary much in size, from .25 in. to 1 in. long, obovate-oblong, smooth and glabrous, green with a narrow border or red on the margins, entire, apiculate at the apex, attenuate at the base.

The inflorescence is compound and consist of cyathia grouped dichotomously and seated upon glabrous peduncles which emerge from the axils of the uppermost leaves. The peduncle is divided into two successively three times and the cyathia are seated upon the ultimate peduncles. Each cyathium is supported by two, petaloid, crimson, orbicular, apiculate bracts which have become fused to the involucre in their lower part. The orbicular or broadly elliptic bracts are glabrous and smooth and are a deeper shade of crimson inside than out, and are .3 in. broad by .25 in. long, often emarginate at the tip instead of apiculate. The involucre itself is about .1 in. long and bears at the top margin five broad, rounded glands which are almost parallel to the long axis. Alternate with the glands is a scale, reddish in colour, and laciniate on the margins. Inside the involucre there are many male flowers, in all stages of development, interspersed with hairy organs which look like sterile stamens. The male flower consists of a pair of anthers attached to a filament which is jointed to a pedicel. The ovary is glabrous, sessile, and is wholly concealed within the involucre, 3-celled, 3-lobed, with one ovule in each cell. Styles, three, connate for half their length, each divided at the apex into a pair of short stigmas.

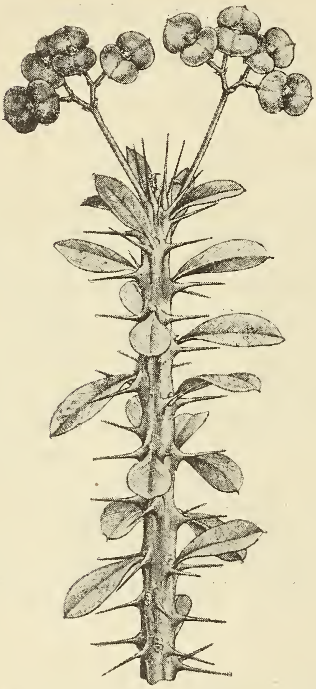

Fig. 3.—*Euphorbia Bojeri* Hook.

Flowers.—Practically throughout the year. Does not set fruit in this country.

Distribution.—A native of Madagascar, very common in gardens throughout the country.

Gardening—A small xerophytic undershrub, armed all over its stem with sharp, long spines. The red bracts and the green leaves on the sinuous spiny stems are very striking. It is well suited for a 'rock-garden', in dryish soil and in exposed and sunny situations. It will, however, grow anywhere but thrives best in a mixture of charcoal, leaf-mould and brick rubble. Propagation by cuttings.

Poinsettia pulcherrima Grah. (**Euphorbia pulcherrima.** Willd.)

Christmas flower.

(*pulcherrima* in Latin means 'most beautiful').

Description.—A shrub reaching 10 ft. in height with a thick short trunk covered with brown bark and numerous slender, unbranched, green branches. Sap copious, milky. Branches cylindrical, smooth and glabrous, green, bearing alternate leaves. Leaves petiolate (petiole 2.5 in. long, slender, curved, smooth and glabrous, crimson on the upper surface), stipulate (stipules glandular), up to

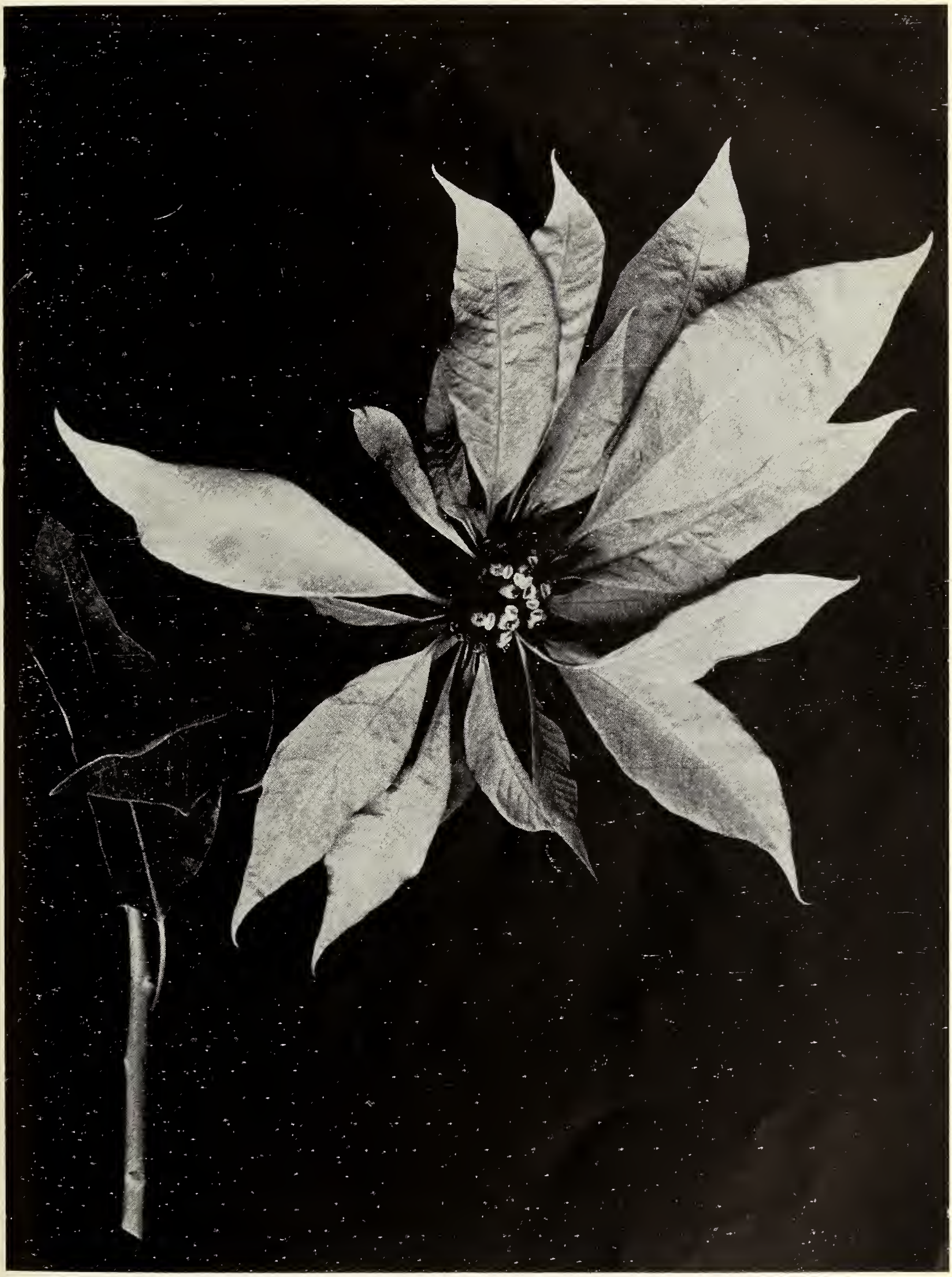

Photo by *M. N. Bakshi*

The Christmas Flower.
Poinsettia pulcherrima Grah.
New Forest, Dehra Dun

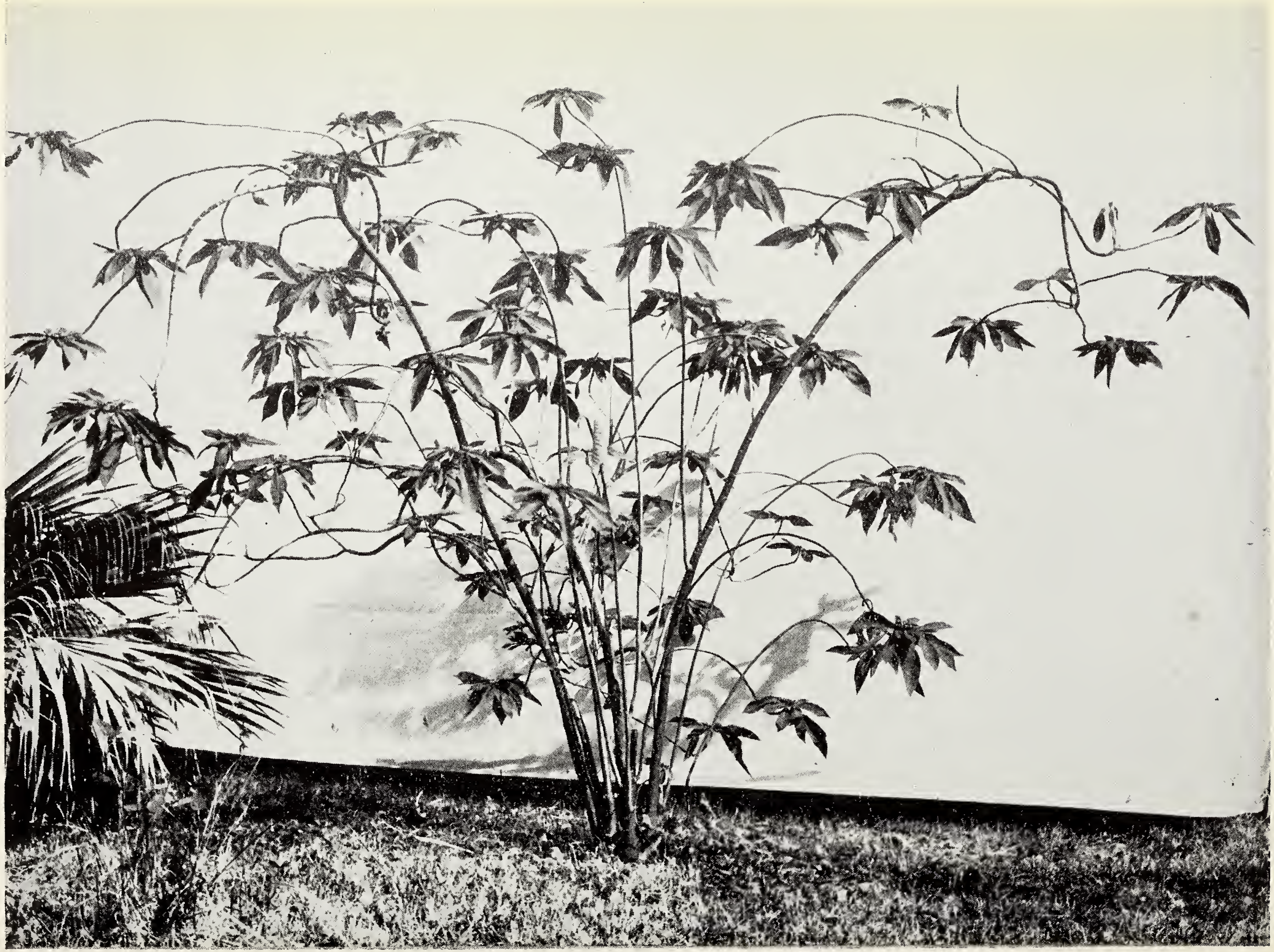

Photo by *M. N. Bakshi*

Poinsettia pulcherrima Grah.

6 in. long by 2-3 in. broad, ovate-lanceolate or elliptic in outline with 1-2 blunt teeth on either side, acuminate at the tip, cuneate or even rounded at the base, smooth and glabrous above, covered with short hair on the lower surface; mid-rib reddish above.

Inflorescence terminal to the branches, consisting of groups of cyathia on stout peduncles supported by bracts, which are usually of a beautiful crimson colour but they may be pink or even white. Bracts oblanceolate in shape, acuminate at the tip, long attenuate at the base, up to 6 in. long by 1-1.5 in. at the widest part. Cyathium seated on a stout peduncle; .25-.5 in. long, ellipsoid-truncate in shape, smooth and glabrous, obtusely 5-ribbed, lower three-fourths green then banded with yellow and finally crimson at the laciniate mouth, or entirely orange on the gland side, decorated at the side with a large compressed conical gland, orange in colour; upper half inside covered with silky, multicellular hairs, glabrous in the lower half. Inside the cyathium there are many male flowers packed closely together, many sterile male flowers, one or no female flowers, and none to several sterile female flowers. The male flowers consist of one stamen, the glabrous filament of which is jointed to a glabrous pedicel, there is no floral envelope. The two 1-celled anthers are, before dehiscence, depressed on either side of the tip of the filament. After dehiscence they come to stand erect like a pair of discs at each side of the tip of the filament. The sterile male flower consists simply of a filament ending in a reddish tip and covered with multicellular woolly hairs. The female flowers consist merely of an ovary jointed to the tip of a glabrous pedicel; ovary hairy or glabrous, eventually erect and thrust out of the involucre, 3-celled, uniovulate; styles 3, joined almost for the whole of their length and then each divided into two stigmatic lobes. Sterile females on glabrous pedicels.

Flowers.—Cold season.

Distribution.—Native of Mexico and Central America, now one of the most commonly cultivated plants in gardens.

Gardening.—A tall, unarmed, soft-wooded shrub, 8-10 ft. high. It bears during the cold weather knobs of insignificant flowers surrounded by deep crimson floral bracts (with variations to shades of pink or even white) which are the chief ornamentation of this plant. It is important among ornamental shrubs as it flowers at a time when practically very few flowers are available in the garden. It is suitable for planting in the open in all areas and is not particular as to its soil requirements. It should be rigorously cut back after flowering, since it is on the current years shoots that the flowers are produced. It is a popular plant for the Christmas season. Readily multiplied by cuttings.

Euphoria pulcherrima Wild. var. *alba Hort.* is a variety with cream-coloured bracts but comparatively of little beauty.

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA.

BY

A. St. J. Macdonald,

(*With 4 plates and 2 text-figures*).

(*Continued from page 205 of this volume*)

Part VI.

Mahseer Fishing in Assam and the Dooars.

Varieties of Mahseer and other sporting fish in Assam (1), Goalpara and Kamrup districts (2), Darrang district (3), Lakhimpur and Sadiya Frontier Tract (4), Sibsagar district (5), Nowgong district (6), Garo Hills (7), Sylhet and Cachar (8), Lushai Hills (9), Manipur (10), Peacock's account of Sarasati—Garo Hills (11), Laour on Puna Teet—From The Angler's Hand Book (12), Notes by Gyles Mackreel (13), Anonymous account on Darrang district (14), Notes on Cachar by Mr. Cooper (15), Further notes on Cachar by Mr. Ewing (16), Notes on Manipur (17), Notes on dark variety of Mahseer (18), Fairweather's notes on Mahseer in Bengal and Assam Dooars (19), Notes by Mr. O. M. Martin (20), Mr. Ritchie's notes on fishing the Teesta river (21).

Assam is a province of hills and mighty rivers, and is, with Burma, the best suited for mahseer in the Indian Empire.

It is intersected from the north-east to the south-west by the great Brahmaputra, which takes in along its course the many fine tributaries from the north, rising in Bhutan, and those rising in the Garo, Khasi, Rengama, Naga and Patkai hills from the south.

Further south, the Barak or Surma with its many smaller tributaries drains the districts of Cachar and Sylhet, all good mahseer water.

It has not come within my good fortune to fish in this province, so I am unable to offer any first-hand notes. I had hoped to solicit the aid of one of the resident anglers, to write a chapter on the excellent fishing enjoyed by the local community, but my attempts failed. So that what should have proved to be one of the most interesting chapters of this book, must now simply be the compiled notes of a few fishermen, who have so generously contributed notes within their own experience.

The hill tracts are almost entirely given up to tea growing, and have in consequence a fairly large European community of planters, amongst whom are a number of keen anglers. Some of the best rivers are protected or leased by clubs, so that before anyone intends visiting the water, he should first of all make full enquiries, and get the goodwill and permission of the local club.

From correspondence I have had, it would appear that unless one did this, or had a friend to help, it would be difficult to get to the best water, as boats and transport are almost impossible to obtain, the best places being considerable distances from rail and road head, The fishing, though excellent, has become a monopoly of the local community, and it would hardly be worth while undertaking a long rail journey, for any but those fortunate in having friends to help.

I am indebted to Mr. Giles Mackreel for the excellent plate of the teeth of the mahseer, with his interesting notes and photos of fish. He records similar types of mahseer from Assam, to those listed by me, in the Burma chapter, pt. V. His notes on the teeth of the different types of fish, are both interesting and instructive. I am also most grateful to Messrs. Cooper and Ewing for their interesting notes covering years of experience. It is interesting to note how the opening up of the country has affected the fishing in certain rivers, over a period of years. I also thank the gentleman who has sent me the note on fishing at Darrang, but who prefers to remain anonymous.

Last but by no means least, I have to thank Mr. Inglis for allowing me to reproduce here certain articles from his excellent journals of the Darjeeling Natural History Society.

I have listed for convenience, and purely by the aid of the Gazetteer, the districts with the larger rivers in them. Perhaps if this book runs to a second edition, anglers will correct or send me up-to-date notes on water within their own experience, so that I can include them in a chapter on Localities.

1. *Varieties of Mahseer and other Sporting Fish in Assam.*—The Mahseer in Assam attains a great size, and appears in many varieties, or more correctly in conspecific forms, as we learn from Dr. Sunder Lal Hora's interesting articles 'The Game Fishes of India' in the Bombay Natural History Society's Journals, Vols. 41 and 42.

Besides the Mahseer, the Bokar (*B. hexagonolepis*) frequents most of the rivers, and affords excellent sport on fly, with the sporting little *Barilius bola* (Indian Trout) and the Butchwa; besides these all the big Silurids are represented, common amongst which are the Goonch, Silund, *Wallago attu*, and Tangra. In the tanks the Rohu, Mirgil, and Catla are taken, along with the Murrel in his weedy haunts.

2. *Goalpara and Kamrup Districts.*—In the west the Gadadhar river bounds the district, and is formed by the two Bhutan rivers, the Raidhak, and Muchu. The Goalpara district is further intersected from north to south by the Champamati, and two other smaller rivers (names of which are not available). The Manas is a stream of considerable size and is snow-fed, and must be excellent up in the hills and at junctions with feeder streams.

> 'A number of rods go up the Manas each year, and usually have good results. But others are doing immense damage.'

3. *Darrang District.*—The Dhansiri is a stream of considerable size and must have excellent water in the hills. The Bhareli is a snow-fed river that joins the Brahmaputra in this district and in size is equal to the Manas.

> 'Mahseer are to be found in the Boanuddy which is the boundary river between Kamrup and Darrang. They are found in large pools in the gorge near the Bhutan border. They are also found in the Borelli near Tezpur and the Manas. In the latter rivers they run up from 40 to 60 lbs.'

4. *Lakhimpur District and Sadiya Frontier Tract.*—N. Lakhimpur itself is on the Ranga, and about 10 miles from the hills.

> 'Here two rods fishing caught a 50 pound Mahseer on Xmas day on a No. 8 spoon.'

Further east the Subansiri, a large stream, flows through the district and is fed by many large tributaries in the Miris country.

> 'This is a very fast river and contains some huge fish. I got a 26 pounder in March and then my boat was upset in a rapid, and I lost all my rods and tackle. Two Europeans have been drowned in it, in comparatively recent years. There is a forest bungalow at Dabing Mukh, and a number of rods go up every year. Silvery and beautiful.'

Further east we come to the Sadaya frontier tracts which have probably the biggest water in the province, and where enormous fish lurk in the waters of the Dihang Sesiri, Dibang, and Luhit rivers.

> 'The Dihang is really the upper water of the Brahmaputra, huge fish can be seen in some of the gorges, but there are sheer cliffs to the water's edge. The water is not cold.'

In the south or left bank the Noa Dihang and Buri Dihang join in, with the Disang and Jhamdi.

5. *Sibsagar District.*—The Dhansiri is the largest river flowing through this district, and should offer good sport above Dimapur on the A.B.Ry. Besides this there are other smaller streams that provide sport with small fish.

> 'Notably the Doiang which can be joined from Jamguri station A.B.Ry.'

6. *Nowgong District.*—The Jumna which rises in the Rengma hills has provided excellent sport with small fish, also the Kapili. Lumding is a convenient railway station for this water, from where trekking must be done.

7. *Garo Hills.*—There are a number of rivers that rise and hold good fish in these tracts. Chief among which are the Krishnai which flows north and the Bhogi, Kangsa and Someswari which flows south. All excellent Mahseer rivers (from old notes).

8. *Sylhet and Cachar.*—The Surma or Barak, with its tributaries, drains these districts and affords excellent sport in the higher and jungly reaches to the members of the fishing club at Silchar, who lease the river from the Government to protect it from poaching. This club protects the Loobah, Barak and Jumtrapai rivers.

Sunamganj is on the Surma, and it is from near here that Laour is reached on the Punateet. (See notes from 'The Angler's Hand Book'.)

9. *Lushai Hills.*—Here some excellent rivers run and very good fishing is to be had almost without exception in the Dheleswari, Sonai, Tipai, Kaladan and Langai Rivers (but no recent notes are available).

10. *Manipur.*—Good sport can be had with fair sized fish, in the Barak, Northern Hills; in the Thopal Eastern Hills; and in the Chakai Southern Hills. Large Mahseer are to be had in the Barak and its larger tributaries the Idang and Makru in the Western Hills.

> 'The largest fish taken in recent years was a 56 pounder, caught by me (Gyles Mackreel) on a Myitkyina Macdonald spoon, in December 1928.'

The Manipur river itself rises in the north of this state, and after running into a large lake (Loktak Lake) flows south and out of the State into the Chin Hills and Burma.

Besides the rivers I have mentioned there are many others of which only local knowledge can assist, and the ways and means of getting to them, must of necessity be obtained locally.

The notes in parentheses are by Mr. Gyles Mackreel, and the note on Boanuddy by J. L.

11. *Recent Notes on fishing and localities in Assam and the Dooars by F. Peacock, Esq.*

'Garo Hills, 36 miles north from Mymensingh railway station. River Sarasati near a place called Durgapur, the best fishing to be had about 22 miles from Durgapur between two villages, Ryuk and Seejoo, and about 2 miles beyond the latter place. The water is well known in the neighbourhood. The best way to reach the water is by rail from Calcutta to Goalundo, 8½ hours; thence by steamer to Narayangunj, 10½ hours, thence by rail to Mymensingh, 7 hours. From Mymensingh to Durgapur is a road good for driving part of the way and for riding the whole way. The place was visited in February with good results. In 1877, 48 fish, weighing 877 lbs., or over, an average of 19 lbs. per fish. were killed by two rods in 3½ days all Mahseer. The best way to fish is with a spoon, from a boat moving. On hooking a fish it is best to land and play him from the shore.'

12. *Laour, Assam from 'The Angler's Hand Book'.*—'The river is called the Punateet and runs out of the Khasia hills at Laour. To get to it, you have to branch off at Sunamgunge (on the Soormah) and go by boat to a village called Elamgao; here you can get dingies and boatmen to take you up the gorge, where you must rough it in a grass hut. It is a beastly unhealthy place. Every time I go there all my servants are knocked over with fever. I got it once, but on that occasion I was there for 6 weeks.'

' Extracts from my Diary :—

' November 19th got nil, lost 4 fish.
,, 20th ,, 1, lbs. 19, lost three.
,, 21st ,, 2 ,, 30, 36.
,, 22nd ,, 6 ,, 46, 31, 41, 25, 13, 12.
,, 23rd ,, 2 ,, 44, 30.
,, 24th ,, 2 ,, 24, 32.
,, 25th ,, nil, gave the good pools a rest, and tried some new water.
,, 26th ,, 3 lbs. 18, 58, 55.
,, 27th ,, 3 ,, 29, 29, 62.
,, 28th ,, 8 ,, 16, 54, 20, 33, 7, 32, 33, 26.
,, 29th ,, 2 ,, 28, 26.
,, 30th ,, 1 ,, 28, tried new water again.
December 1st ,, 1 ,, 21.'

Col. H. S. Wood writing in the Journal of the Darjeeling Natural History Society, Vol. VIII, No. 1 of the June issue of 1933. 'When I left the Military I was fortunately posted to Sylhet. In this district Ommaney, mentioned in Thomas' "Rod in India", made his fabulous bags of Mahseer. I soon found out the best places, they were the Ponatite at the N.W. corner of the district where the river debouched into the plains through a lovely gorge in the Sunamgunj sub-division. I shall never forget my amazement, when I first gazed on this fisherman's paradise. There was a huge pool, several hundred yards long, now and then I saw the red fin of a Mahseer protrude above the water and the *Chilwa* scuttled along the water as one of those fish rushed for them.'

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* Probably means the Someswari.

'Consequence was that after each mighty rush, traces and line gave way and I lost all my fish and most of my spoons. I threw away the remainder of that tackle and ordered a new lot from Hardy, Manton and Luscombe. On my next visit to this place I got some nice fish and secured a Goonch (*Bagarius yarellii*) of 67 pounds with which I had great fun.' 'This Ponatite was a fascinating place. In the higher reaches the cliffs rose abruptly from the water's edge and the rocks assumed all sorts of fantastic shapes. On some of them I noticed writings in Urdu and visited a wonderful cave, full of bats. The higher reaches are difficult for boats as there are rapids, up which a dug-out cannot pass. There is also no path along the edge to reach the pools beyond, a folding boat is of no use, so the Mahseer is safe in those higher pools. Hard by the Ponatite is the Tangour Haor, which at one time swarmed with Sambhur, Hog-deer, Pig, Buffalo and Tiger, but like all places in India the game has been decimated by Zamindars, and slaughter during heavy floods.'

'Mr. Gyles Mackreel writing of this River, points out that the course of time appears to have changed the name of the Ponatite. He writes "I think this must be the 'Gohairi' or the 'Piyain' of modern maps." '

13. *Notes by Mr. Gyles Mackreel.*—'The only rivers I have fished personally are Loobah, Barak & Tepi, Kinshyiang, Goomra, Toorsa, Jaldacca, Malangi, Soobansiri. The Loobah runs up into the Khassia Jaintia Hills, past a tea garden of the same name. As the fish pass up and down there is fair fishing in the lower reaches, but the Mahseer all make for the top, and in Oct. and Nov. one will hardly get a fish down below, as those that are going down have gone, and the ones remaining are three days' journey up into the hills. I have been up several times and my best fish is a 32 pounder. They run larger, as I have found two of the short gilled variety killed by Otter which must have been over 50 lbs when fresh as they weighed nearly that putrid. You will see, the gills are far shorter than the common Mahseer. My theory is that it is a bottom feeder that lives, when large, on crabs and large water snails as the teeth are quite different to those of the ordinary Mahseer. I am having a photograph made to show this difference and will send it to you. Is it a big carnatic carp?† I have caught these up to 15 lbs. but never bigger. In Assam the carp is called the Boka. It fights very well indeed. In Cachar and Sylhet they call it the *Maugri.* The Mahseer being the *Mahoal* and the variety of Mahseer I have marked X being the *Pukki ranga.* This latter fish is (your copper fish?) deep and thick. It does not seem to go above 20 lbs., or at any rate

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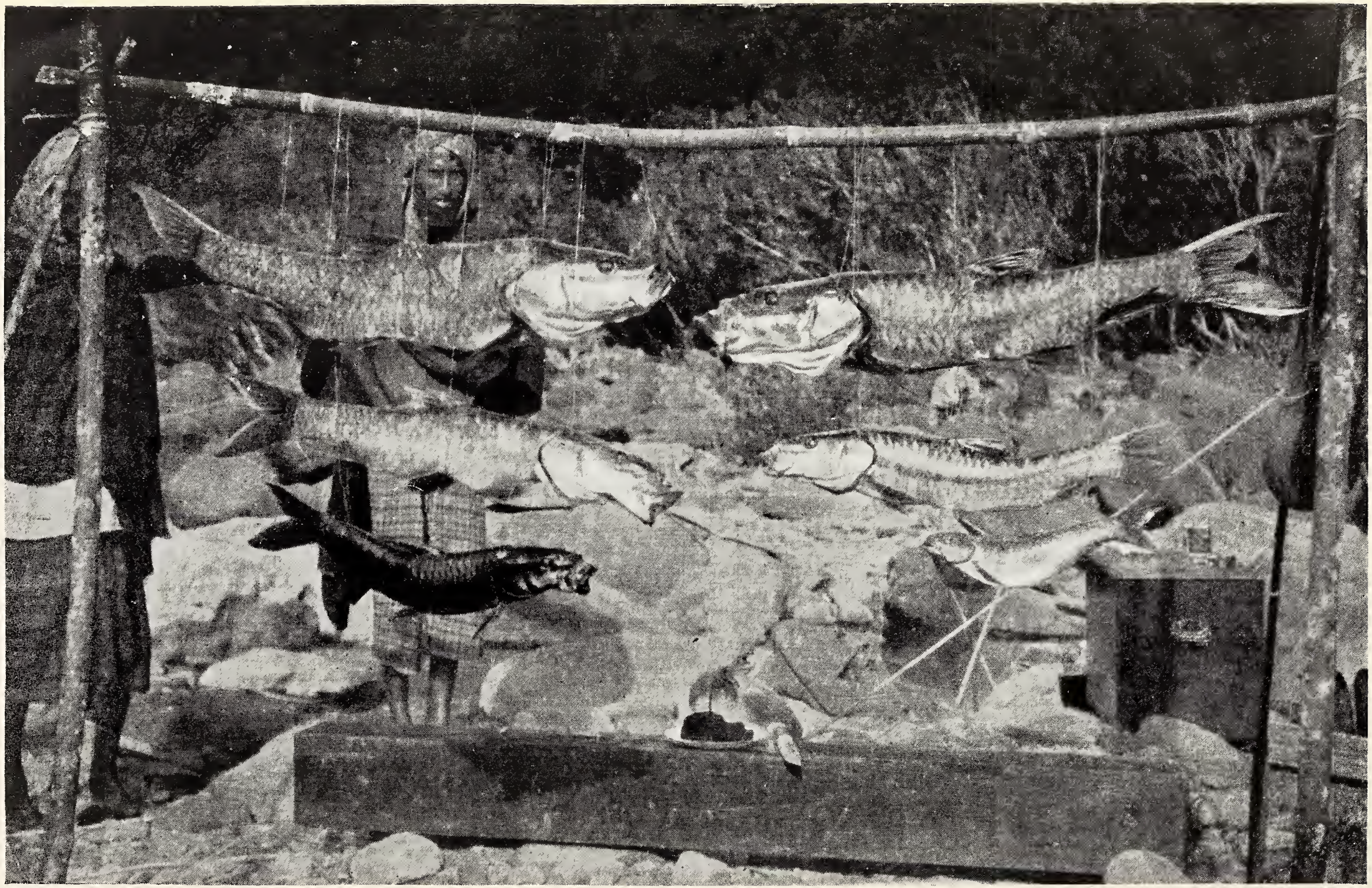
* Between Mr. Peacock's note, and Col. Wood's it should be possible to locate the famous spot, and further notes prove interesting. Neither the 'Gohairi' or the 'Pivain' are mentioned on my maps.

† This is *B. (Tor) tor* (Hamilton). 'The common grey normal type is *B. Tor putitora*, as identified by Hora.



Typical long-gilled Mahseer caught on Xmas day 1930, in the Singlar, a branch of the Loobah River in the Khassia Hills. Note the Black Mahseer in the left corner, and the Carnatic Carp or 'Mangi' in the right corner.

25 lbs.	23 lbs.
20 lbs.	18 lbs.
12 lbs.	6 lbs.

(Note the Xmas pudding on the Rod Cases.)

to take a spoon when over that weight. It is a beautiful bronze above, with red fins. The one in my photograph has thick red lips, but I have caught a fish that seemed exactly similar but with ordinary lips. I have found that the Carp all have teeth similar to those in the big fish on the unprinted film, i.e. one huge molar and the usual number of small teeth, the older the fish the more these teeth are ground down. In the *Pukki ranga* the teeth are the same. In the ordinary Mahseer the teeth are sharp, even in big fish. This I think points to the diet, fish and vegetable matter very largely in the ordinary long, gilled Mahseer, crustaceans, etc., in the case of the others. (The lips enlarged through turning over stones in search of Crabs, etc.?) Huge short gilled fish are occasionally caught on *atta* in the Brahmaputra at Amingaon and Gauhati. One caught last year weighed 90 lbs. This was the *Boga pitia* or white Mahseer of the Assamese as distinct from the *Lal pitia* or ordinary (red) common long gilled Mahseer. What the *Boga pitia* is like when small I do not know. I have never caught a big one; and when small he may be the Carp or the *Pukki ranga* both of which are rather like your Chocolate Mahseer.'

'I am going off on a two months fishing holiday in Oct.-Nov. and will then send you, or the Bombay Natural History Society, whichever you like, skins of the various types. I will simply take the insides out and stuff them with salt and straw. I will of course send the description of the colour of the eyes, etc.

'Loobah. This river runs into the Khassia-Jaintia Hills. On entering the hills one comes to a huge gorge pool some three quarters of a mile long. This is full of huge rohu, etc., but I have never taken a big Mahseer out of it although it looks ideal. Upstream from this pool the river ascends the hills in a series of rapids and pools. About 8 miles into the hills it becomes the Lunar. The latter forms a series of lime-stone pools and rapids and has no very big fish in it in the cold weather. The other branch, called on the map the Luka but locally the Singlai, dries up at the junction for a matter of some three quarters of a mile, as the river enters a cave higher up and flows under ground for that distance, joining the Lunar and the Loobah under the surface of the latter. This means that fish that have not passed over this barrier while it is still under water in September, remain above for the whole of the cold weather. There are some fine pools, but otter are very plentiful, and the fish get killed off as the water drops. The best fishing is therefore as soon as the water clears in October. Carp are very plentiful and take a fly readily. One rod took 39 fish in one day, nearly all on fly and averaging about 4 lbs. My best bag, fishing with a No. 7 spoon was 13 fish in two days averaging 11 lbs. At that time one could have got a very large numerical bag by the use of a yellow spider or small fly spoon as the smaller fish were taking very readily. I took one coal black Mahseer weighing 11 lbs. The tips of the fins were gold.

'The Kinshyiang is the name given to the Jadhukata where this river enters the Khassia Jaintia hills not far from the border of the Garo Hills. This river had not been fished for some years when I went up it at Christmas 1931. This was the worst time to go as the lower reaches had all been poached, and netting was in progress in the upper reaches, when I got there. I have applied for Government protection for this river. I found one good pool where the poles for netting were lying ready. It was full of good Mahseer and on Xmas day and Boxing day, with the temp. at about 39° and the water like ice, I got 11 fish averaging 20 lbs. the best fish was 41. There were some very large fish to be seen but I had not got any dead bait and could not get hold of any, and I was fishing with spoon all the time. A No. 7 gave the best results, heavily leaded to get to the bottom. All these fish were the ordinary long guled red finned mahseer. They fought well.'

This river is difficult of access and I used 100 gals. of petrol getting there and back in a motor boat; and one is liable to get all the way there and find the pools have been cleaned out by poachers. The Subansiri is a direct tributary of the Brahmaputra in North Lakhimpur. It is fished by the Local Government Officials and by Planters in Assam. It is very fast and contains some large fish. One has to hire dugouts from the local Miris who are far from trustworthy. On my last trip some of these experts upset a dugout in a bad rapid and I lost all my rods and reels and a 12 bore gun. Mr. Aitken of Tezpur, a well known Assam sportsman, hooked a huge fish the following day but it broke him after 40 minutes without having shown itself. The lower pools of the river are rather a favourite fishing ground for people who want to fish in comfort, as there is a forest bungalow on the river bank. The fish are therefore quite used to all kinds of baits and spoons being trailed from behind a boat and act accordingly. The fishing trips seem to become river picnics. Knowing this I thought I would try something that the fish had not perhaps seen recently so I mounted 3 six inch fish in a spinner so that they appeared to be swimming in echelon together. The result was a 26 and a 16 pounder in half an hour from water that 7 rods had been fishing a few days before with no result. A fluke? Probably. But worth trying again.

The Toorsa and Jaldacca are both Dooars rivers. The typical Dooars Mahseer seems to be golden brown backed, silver belly, and orange or pale lemon fins. A lovely fish. The other fish is the '*Kutli*' which is very much like the Assam carp and is probably the same fish under slightly different conditions. He is like your Chocolate mahseer to look at but only goes up to 10 lbs. I am told. My best is 8 lbs. I will send you a picture of one, side by side with a Mahseer. He has the flattened teeth of the carp.

The Barak is a finished river. Poached from end to end. Two years ago 500 Lushais came down and netted and poisoned all the pools within a few hours of Silchar, dried the fish and went off into the hills again. Ichabod! The river used to be full of magnificent fish and my best bag was thirty pounders and a number of smaller fish in one day.

'The last time I went up I got one four pound fish, and the trip entailed 8 days leave and cost about Rs 300.'

'The Malangi used to be good but the Toorsa has now cut into it and all the shingly pools are now sand and the fish do not stay. The Goomra is a small river in the Cachar hills parallel with the Kalain. It holds fish up to 8 and 10 lbs. in the late rains, but in the cold weather there is nothing big to be taken.

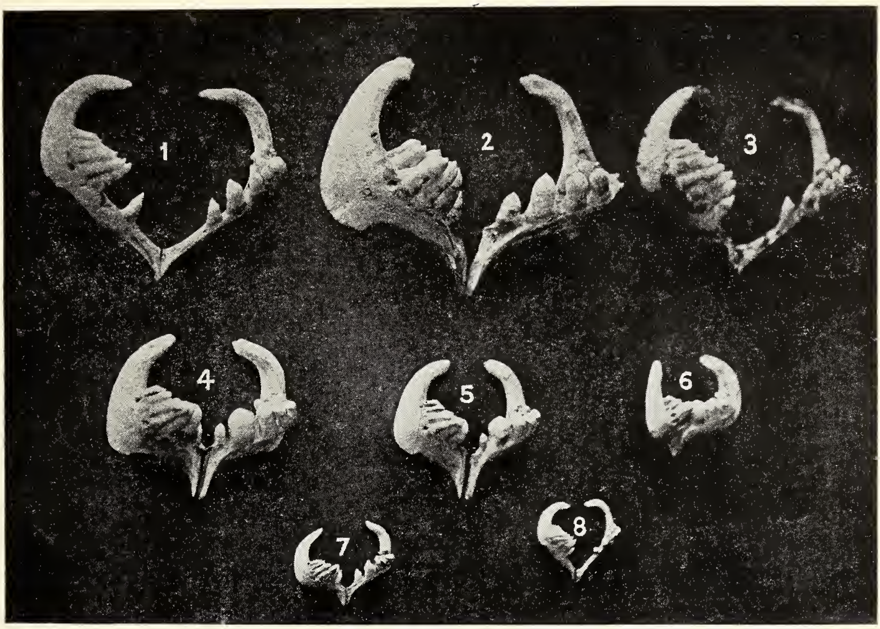


Fig. 1.—Teeth of Mahseer in Assam. Illustrating the sharp teeth of the large-headed variety, and the blunt teeth of the short or small-headed variety.

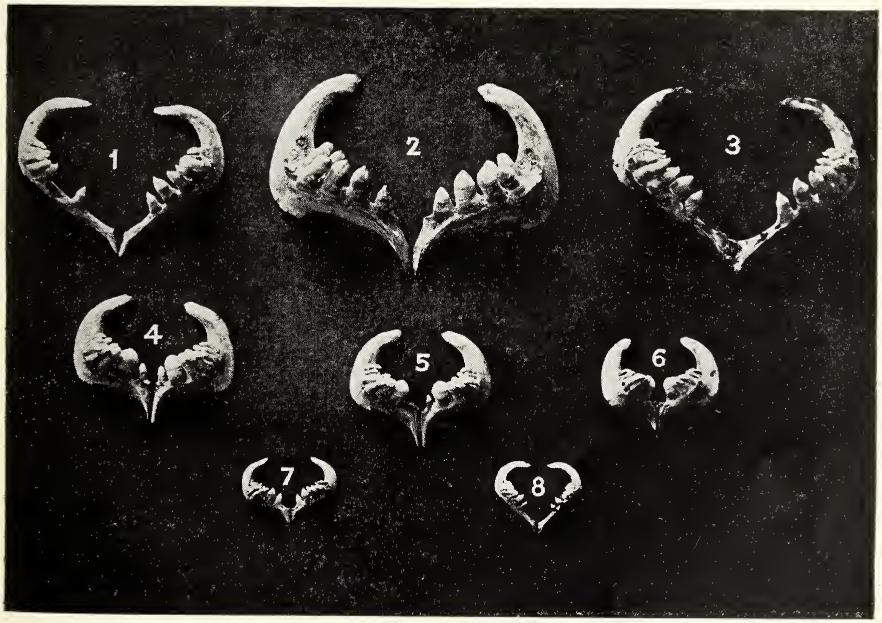


Fig. 2.—Variation of the teeth of the varieties of Mahseer in Assam, as observed by Mr. Gyles Mackrell. (The short gill or small heads have blunt teeth. The long-head or the ordinary variety stand alone in sharp pointed teeth.)

'I am afraid this is very disjointed but I will endeavour to write you more later.' The Manas is one of the famous Assam rivers. It is in a game reserve and a special permit is required. I am going up this year but as yet I have no first hand knowledge of it. It is a direct tributary of the Brahmaputra, like the Rydak and Sankhos.

'5-8-'32 I send you some photographs of fish teeth. The point is that the long-gilled Mahseer seems to stand alone as far as teeth go. He is the only one with the *sharp* teeth. The big short gilled fish (I sent you a film of a 50 pounder and I took a photo last month of a 64 pounder but it was in a part of a cine picture and I have not had a print made yet) the short gilled fish has blunt teeth with the one big molar. The carp or *Cutli* of Assam, the Dooars and Sylhet (Assam, *Boka*, Dooars *Katli*, Cachar and Sylhet *Maugri*) all have the blunt teeth. So has the copper fish and the thick lipped fish. The black Mahseer (simply a melanic example of the true long gilled variety) has teeth, scales, etc., exactly as the ordinary coloured one. By black Mahseer I mean *black*. You will see one in one of my pictures.

'I was talking to a man who came down the Manas recently from the upper reaches in Bhutan and he tells me he watched them catching Mahseer there with strips of a scaly gourd off the trees. He was not a fisherman, but he had photographs of the fish. I have caught them on a scaly spoon but seldom.

'Up the Sonai, Cachar, one fisherman finds the best thing to use is a No. 8 spoon with a treble mounted on a 7 in. length of gimp. The shank is bound with a little red wool. The fish come short at the spoon in gin clear water and seem to suddenly see the little red thing spinning at the end of it and go for it. I have tried it once and caught a fish, but personally I prefer my treble in the centre of my spoon and one flush with the end.'

14. *Darrang, Assam.—By an Angler who prefers to remain Anonymous*, 7-6-'32. Darrang, on the north bank of the Brahmaputra holds some very fine rivers, and water can be found to suit the taste of any fisherman. Tezpur is the only town in this district and is approached by a daily service of river mail steamers up and down the Brahmaputra from Amingaon; these steamers continue up stream past Tezpur, touching at various Ghats or Mukhs, to the terminus Kokilamukh; reference will be made later to the various Ghats at which the intending visitor should disembark should he wish to visit a particular river. I would say at the outset that it is useless to come to this part without a full camping outfit. Stores can of course be obtained in Tezpur, and there is ample accommodation to be had either in the *dak* bungalow or the floating residential flat at Tezpur ghat. From this temporary base, the intending fisherman would have to make arrangements to approach the Bhoroly river, which is the largest in Darrang; I would advise him; in fact it is essential to write to the Political Officer, Balipara Frontier Tract, Charduar, Lokra P.O., which is some 20 miles from Tezpur, informing him of his desire to fish and shoot on the Bhoroly. As a matter of fact a Fishing and Shooting Association is in the process of formation in this district, and should it become a going concern, the Political Officer would put the visitor in touch with the Secretary. In any case the next move should be to Charduar from where a 'political' road runs for 22 miles into the foot hills practically along

the banks of the Bhoroly. Either of the above gentlemen would help the visitor to obtain dug-outs, without which it is useless to attempt to fish this river. One boat for each fisherman is definitely necessary, for which he will have to pay at least Rs. 3 per day; the Miris who work and hire the boats are very knowledgeable as to the best water and times to fish; also as regards the game, which at certain times is plentiful in this part; I should make it clear that after leaving Tezpur, which can be done by rail to Balipara, within a few miles of Charduar, the party should be entirely self-supporting and camping out will be the order of the day, as there are no *dak* bungalows or shops in this direction, after Tezpur. The way, *par excellence*, of working this part, or the whole of Darrang for that matter, would be to bring a car, preferably with a trailer for baggage; every river would then become accessible, especially the Bhoroly, as the 'political' road is always in excellent order, the fisherman is then completely independent of that terror in Assam, and probably elsewhere, the *gharry-walla*. I strongly urge this course to be adopted should any one think of a fishing trip in Darrang. Presuming the party to have safely got into camp on this river, with the requisite number of boats, they will find plenty of good pools wherein the only method of fishing is by trolling. Anything up to 60 lbs. (I am speaking of Mahseer), may be expected, while for this a No. 7 or 8 spoon is the usual thing and a local secret is to attach a piece of red wool or ribbon to one's spoon; live bait is also a successful lure. Good spinning water will be found every quarter mile or so Fly fishing is not much use on this river, but up its tributaries, especially the Namri, a fly fisherman will obtain good sport. I treat on fly fishing separately however as the Bhoroly is essentially a trolling and spinning river, but subsequent remarks on fly fishing, would apply to most of the tributaries. The Bhoroly is affected by snow water after about the first week in May. The best times to fish would be from November on to March. The first month or two I believe to be the best; but the latter period, if not quite so good for fishing, is balanced by the better prospect of seeing game, anything from bison and buffalo down to barking deer may be met with; and if the party hire an elephant, which would be quite possible, some very good big game shooting could be obtained; in any case, a fairly heavy rifle should be part of one's equipment. As all this country is within the Balipara Frontier Tract administered by the Political Officer, his permission must be obtained before any shooting or fishing is contemplated.

'Another typical river of Darrang, also in the Balipara Frontier Tract, and one of which I have far more intimate knowledge, is the Boroi; a small stream issuing from the Daffla foot hills. It is far smaller than the Bhoroly. This again is quite easily accessible by car, either by road from Tezpur, some 55 miles, or by disembarking from the steamer at Gomirighat, but there are no *dak* bungalows worthy of the name, nor is it possible to obtain stores, Tezpur being the nearest place. The Boroi is a delightful river, wooded banks, short rapids, many deep pools, and as one goes up stream, the river runs through beautiful gorges. This river is ideal for fly fishing, both from the banks and more especially from a boat; after a little practice it is quite easy to stand up in the dug-out, and drift down one of the beautiful gorges casting a fly on the water which laps the precipitous sides. The fish, which I believe to be true Carnatic carp, local name "Boka," can sometimes, when feeding, be seen on the surface, and it is wonderful sport to select a large one and put the fly over him. I have caught up to 16 lbs. on a very light fly rod. You can sometimes see the fish lazily open its mouth and gently suck in the fly, then a quick strike and away he goes. Sometimes these fish take a lure with a rush, but more generally as above described. Then again the rapids hold large mahseer, easily up to 40 lbs; and some very pretty sport, spinning, with anything from a No. 6 spoon, can be had. A fly spoon in some of the lesser rapids sometimes produces good baskets; altogether the streams in Darrang of this type provide some delightful fishing. December is not a good month for these smaller rivers, I would say late October, if the cold weather has set in early, and November and February-March, especially the latter, as these smaller streams are unaffected by snow water. All through the hot weather good fishing may be had, provided there is no thunder about, which seems to send the fish clean off the feed. As regards fly, No. 6 hooks Limerick scale. The Coachman is a never failing lure, also the Zulu, in fact any sea-trout fly will do, mounted on a Salmon cast, with about 100 yards of line.

'The fishing rivers of Darrang may therefore be divided into two categories, A and B.

A. The Bhoroly, a river suitable for a large party and fairly easily worked, within reach of Tezpur, if the party is provided with a car; and B., the Boroi; a typical example of which I have described, suitable for one hand or at most two, where they must be entirely self-supporting; but again not too inaccessible if the party have a car. It must be understood, although I have not marked them on the sketch map, that the district is thickly dotted with tea gardens, all round Tezpur and east to the Boroi, beyond which there are a few gardens, and the intending visitor may safely rely on getting help and advice from the planters.'

'40 miles further east lies the district of *North Lakhimpur* in which several fine rivers are to be found, but of which I have no personal experience. One in particular, the Subansiri, which is far larger than the Bhoroly, is I believe a wonderful river for large Mahseer. On the whole the Mahseer and *Boka* (Carnatic carp) are the two principal fish to be found in all these rivers; the latter takes fly well, also spoon, the former is essentially a fish to be caught on the spoon, and only occasionally takes a fly.'

The Bhoroly is a large snow-fed river suitable for a party of 3 or 4 rods, and approached as above described.'

B. 'The Bor Dikrai, although a tributary of the Bhoroly, deserves to be classed by itself, or rather in the Boroi class.'

'Borgang river and its tributary the Dikal. Means of approach either by road from Tezpur or by river steamer to Behalimukh, or Kathnibrai ghat, P.O. Borgang; suitable for 1 or 2 rods, boats not essential but would be very useful. Good big game shooting, no *dak* bungalow.'

The Boroi. Means of approach by road from Tezpur or steamer to Gomirighat, P.O. Halem, suitable for 1 or 2 rods, boats essential; good big game shooting.'

15. *Notes of Fishing in Cachar by Mr. Cooper.*—Mahseer fishing in Assam Cachar. I have done some little during the last 30 years. My personal experience only extends to one district of Assam-Cachar and before dealing with the headings you have given in your questionnaire—I must explain that there is practically no good fishing to be obtained without making an expedition up one of the various rivers into the hills in Manipur Lushai country. This means that one must have boats and a crew, with outfit and generally the use of a motor boat to cover the lower reaches of the river, if one is to get to one's fishing water in a reasonable time. You will therefore understand that it is difficult for any one not a local resident to make a *bandobast* to get to the best water as there are no roads or accommodation of any sort when one gets there. In my young days, the smaller rivers used to provide us with very good fly fishing in October and November and one could reach these on a horse; but increasing population, cultivation, and netting, have made these rivers hardly worth a visit. I will therefore confine my remarks to rivers that I have fished in recent years. Those are the Barak with its tributaries the Jheeri and Tepi; the Sonai, the Loobah—the higher reaches of which are leased from Government at a nominal rent and protected as well as possible by the Surma Valley. Angling Association during the cold weather months.'

'An expedition starting up any of these rivers would have to outfit in Silchar, which is anything from 50-100 miles from the best water. Membership of the Surma Valley Angling Association can be obtained from the Secretary at Rs. 10 per annum. None of the rivers are snow fed.'

'The Barak holds big fish, which are caught by trolling or spinning—with a dead bait or spoons from No. 7-9. Most of the big fish are caught trolling and one rarely gets anything over 15 lbs. spinning. (Probably because Anglers do not fish deep enough. A. M.)'

'The Tepi is, early in the season, good for fly and small spoons, big fish caught spinning have been rare in recent years. The Jheeri is far the best river for fly—those I have been most successful with Yellow Spider, Claret and Mallard, Blackamore, all large size. Fish up to 15 lbs. are caught spinning. All fly fishing is done from a boat. The Loobah can be reached by boat from the Surma and is probably the easiest to get at, it also holds fish up to 50 lbs. both Spoon and Fly do well at the right time.'

The Sonai. 'Some excellent bags have been made up this in recent years chiefly by Mr. Ewing, the Secretary of the Surma Valley Angling Association. Like other rivers in Cachar one must be prepared to camp and travel 3 or 4 days in small boats before getting into really good fishing water.

'All these rivers fish best as soon after the water clears as possible i.e. November and December—the Barak which is a larger river, I have done well on in February.'

'One can generally shoot enough for the pot in the way of jungle fowl, pigeon, odd duck, an occasional deer and serow. Gharial are still fairly numerous on the Barak. Dense jungle down to the river bed makes stalking impossible. Very unhealthy, and feverish between November and March.'

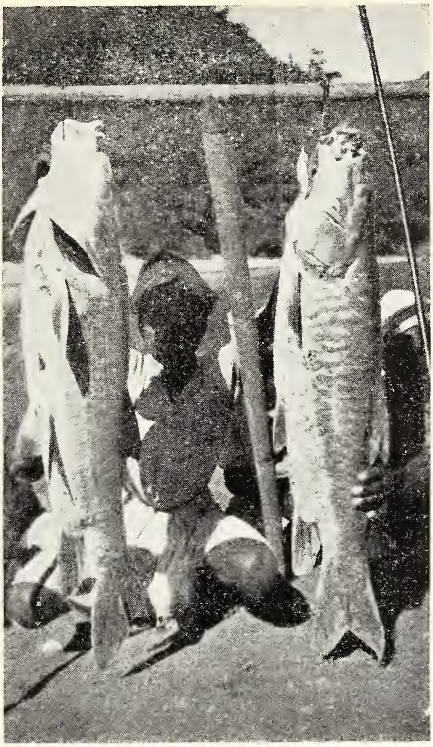


Fig. 1.—Two ordinary Barak Mahseer : 30 lbs.

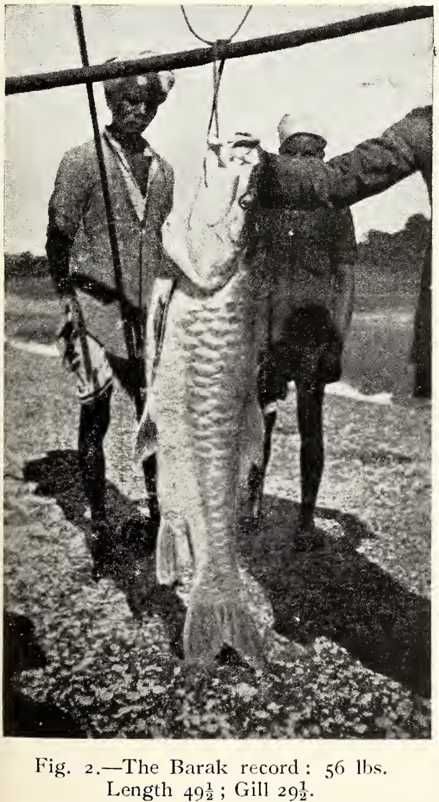


Fig. 2.—The Barak record : 56 lbs.
Length $49\frac{1}{2}$; Gill $29\frac{1}{2}$.
A snap out of Mr. Cooper's Notes.

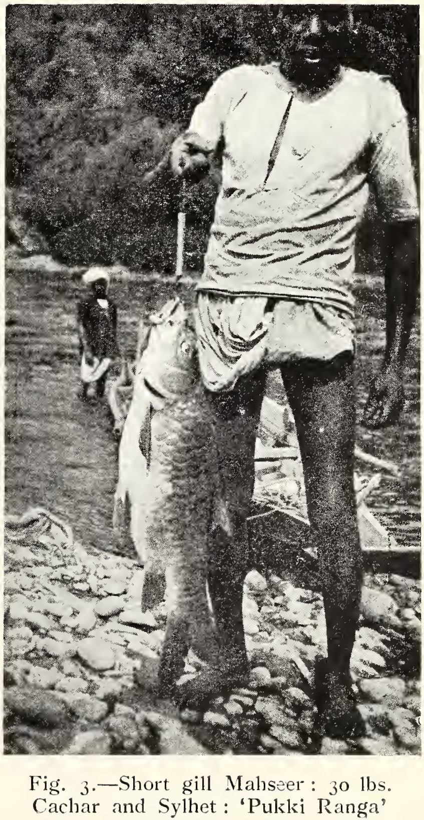
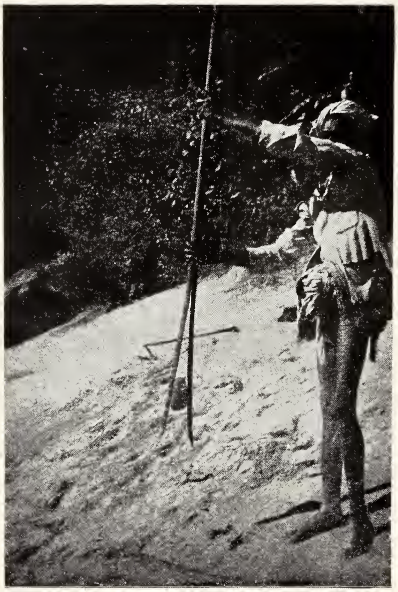


Fig. 3.—Short gill Mahseer : 30 lbs.
Cachar and Sylhet : 'Pukki Ranga'
Flattened Teeth.

(1) Opening gorge of the Loobah.



(2) A stone lashed between the jaws of a split bamboo. (After smoothing the edges with a knife.) Very useful in 8 or 10 feet of water to rescue a hook from a boat,

'Supplies can be obtained from the Manager, Cachar Club, who could possibly arrange for boats and men; but as you will gather from what I have written before—this is not an easy *bandobast* for any non-resident, or to be undertaken unless one has a month or more to spare.

'There are two or three distinct varieties of Mahseer caught, also what is locally known as a "Carnatic Carp" the *Boka* of Assam. *Butchwa* up to 2 lbs., also take a fly well at times.'

'Bags' Barak. In 1928 two of us landed 51 fish weighing 388 lbs. in five days actual fishing—largest fish 56 lbs., which is a record for the river. In 1931 we only managed to land 35 fish weighing 185 lbs. largest 15 lbs. in about the same time.'

'Jheeri. In 1930 two of us in 5 days actual fishing landed 104 fish averaging just under 3 lbs.—all mine except one 12 pounder were caught on 10 ft. rod, on Flies.'

'I cannot give you any recent "bags" on the Sonai or Loobah. Mr. C. E. Ewing has done very well up the former, but in recent years the Loobah "bags" have been very poor and it becomes necessary to go higher and higher every year to get good fishing, which adds considerably to the expense and time required.'

'I doubt if you will find in these notes much to encourage any one to make an expedition into Cachar for fishing purposes, but trust they will be of some interest to you. I fancy the country and fishing are very much like Upper Burma on the other side of the watershed, but are being ruined from a fisherman's point of view by increasing population.'

16. *Further notes on the Cachar District by C. E. Ewing, Esq.*, 3-5-'32.—'My personal experience only extends to one district of Assam-Cachar and I have only experience of fishing one small river, the Sonai, a tributary of the river Barak. Mr. W. E. D. Cooper, I understand, is writing you regarding fishing prospects in other rivers in Cachar of which he has had considerable experience, so I will confine myself to the Sonai river which I know best. Before dealing with the details of the Sonai river, I would like to say that good fishing is only obtainable by several days journey up the river from Silchar and no organisation exists whereby outsiders can receive help in arranging boats, crews, etc.; and boats are essential, as no other means exist whereby one can reach the fishing waters. With the increase in population more land is being opened up along river banks, which means that one has to go further and further up the rivers each year to reach good undisturbed fishing water.'

'The Sonai is a small river rising in the Arrakan Hills, its course South to North, when it eventually joins the river Barak at Sonai Mukh, 12 miles from Silchar. This river suffered badly during the severe floods in 1928, from landslides but is improving again gradually. The best time of the year for fishing is between the months of November and February; during the rains the river is high and extremely muddy. I have had very good sport indeed on this river for several years. Dense jungle growing down to the river bed makes fishing only possible from a boat. Fly fishing, with Yellow Spider, Clavet and Mallard, and Blackamore, and underhand casting with spoons (Nos. 7 and 8) have been found to be most successful. Being only a small river it does not hold very big fish, the largest landed was a Mahseer of 26 lbs., but several have been caught between 12 and 20 lbs. The only drawback to the river is that it abounds with snags—trees and logs that have slipped down into the river in the course of years, and any angler going up this river must be prepared to lose a lot of fish and tackle, so should have a good supply with him. The biggest bag made was in 1925 when two of us landed 100 fish weighing 550 lbs. in 5 days actual fishing—the largest fish 26 lbs. To an Angler who is not out for big fish lots of sport can be had with fish of 5 to 20 lbs. in the Sonai. The fish obtainable in this river are Mahseer, Carnatic Carp, Butcha and Fresh-water Sole.

'There is also lot of shooting available—jungle fowl and pheasants, pigeon, and duck and deer, both sambhur and barking. I have had very good shooting indeed up this river and can usually secure more than one's requirements every day for the pot. In fact for expeditions up this river take little in the way of stores and rely on success with the gun.

'I doubt whether you will find in these notes much to encourage any outsider to make an expedition up this river, but I trust that these notes will be of interest to you.'

'*Locality.* Cachar Rivers. Silchar is the jumping off-place for all of these, *viz.* :—Barak, Jhiri, Sonai and Loobah which are the principal protected rivers under the Surma Valley Fishing Association of which Mr. C. E. Ewing of Chingoor T. E., Binnakandy P.O., is Secretary.'

'Barak. This is the largest river and rises in Manipur. Small boats can be engaged in Lakhipur, distance by road from Silchar 18 miles and by river about 50, taking 2 or 3 days for small boats to get there. There is a rest house at Lakhipur, also a post and telegraph office. The best plan is to go by motor car or lorry to Lakhipur taking all kit and stores, which can be purchased at very reasonable prices at the Cachar Club Stores; stay the night in the rest house and start off early in the morning. There are good 'camping places' but it takes 3 or 4 days to get to the fishing parts. Once away from Lakhipur there are no post offices or rest houses. All information can be had from the Secretary of the Cachar Club. The best months for fishing the river are November to February.'

'There are large Mahseer in this river and the record Mahseer was about 60 lbs. (Gyles Mackreel's 56 pounder). Most of the pools give beautiful spinning, and the long ones can be trolled as there are few snags.'

'It takes 8 days to get to the Hatti Rocks which is usually as far as boats go, but it is possible to go beyond and the keen man is well rewarded.'

'Jhiri. This is a tributary of the Barak half a day beyond Lakhipur; but the bed is filled up very much with sand and very slow progress is made. It affords excellent Fly Fishing. October and November are the best months, as after that the water is short. The remarks given under Barak about arrangements apply here.'

'Sonai. This is another tributary of the Barak and goes into the Lushai Hills. Good catches have been made and there is excellent spinning, but is spoilt by the number of Snags. The same remarks apply as given for the *Barak.*'

'Loobah. This is a very interesting tributary of the *Barak* and unsurpassed for scenery. October and November are the months as water is short later on.'

'Boats can be arranged at Loobacherra by the manager of Loobah T. E., Kanaighat P.O. Stores can be provided at Silchar and then kit can be taken by train to Badarpurghat Station and by a 200 maund boat to Loobagnat where fishing boats are arranged.

'Two days up the river the junction of the *Singli* is reached and if there is plenty of water the Singli will give good fishing.'

'The Loobah is blocked by large rocks and the scenery is magnificent: both tributaries go into the *Cassiya Hills*.

'There is good Fly Fishing to be had, chiefly Carp on "Yellow Spider".'

'Mahseer and Carp are the only fish in these rivers except a very occasional trout. Any kind of spoon will do.'

17. *Notes on Manipur,* 13-4-'32.—A correspondent from Manipur State writes as follows:—'I am afraid I am not a fisherman and cannot give you much assistance.

'There are no really big rivers in Manipur. Small "*Boka*" Carp (Assamese name) and a few Mahseer can be caught in the Barak (Northern Hills), Thoubal (Eastern Hills), and Chakpi (Southern Hills,) and in some of the tributaries of the Barak in the South Western Hills. Best bait fly, small spoons or dead bait. Large Mahseer can be had in the Barak, and its larger tributaries, the Irang and Makru, in the Western Hills.'

The following notes are very kindly sent to me by the Curator of the Darjeeling Natural History Museum (Mr. Inglis) from his excellent journal.

These interesting notes deal with most of the varieties of fish to be taken, though some confusion arises in expression, by the different contributors, and it is as well to list the correct names of the fish referred to.

(1) The Greyhound type of Mahseer of Assam, my 'Golden Mahseer', is identified by Hora as the Putitora Mahseer (*Barbus tor*) *putitora* (Hamilton).

· (2) The short gilled Mahseer as shown in the illustration of 30 lbs., '*Pukki Ranga*' is identified by Hora as the Tor Mahseer *Barbus tor tor* (Hamilton).

(3) The fish known as the *Boka* or *Katli* by some, and referred to as the Carnatic Carp by others, is *Barbus hexagonolopis*, probably my 'Chocolate Mahseer.'

18. *Notes on a dark variety of Mahseer by E. O. S.* (*Journ. Darjeeling Natural History Society, Vol. VI, No. 2, Oct.* 1931).—The sketches show:—(1) The head of an 8½ lb. fish of the dark variety of Mahseer reduced to half size for comparison with the sketches of ordinary Mahseer sent recently. This is a thick lipped fish. (2) An outline sketch to scale (½) of an 8 lb. 'greyhound' Mahseer (above), and the 8½ lb. dark fish below.

I compared the dark fish with other Mahseer ('greyhound' and 'ordinary') at the same time (Sankos, 22nd February 1930) and with *Kath.* The impression which this comparison made on me, at the time, is best described by saying that:—If the dark fish had been compared with a Mahseer alone, it might have been taken for a *Katli* and if with a *Katli* alone it would undoubtedly have been pronounced a Mahseer. The dark fish, in other words, is in appearance, as nearly as possible, half way between what we believe to be the typical *Barbus tor* and what we believe to be *Barbus hexastichus*.

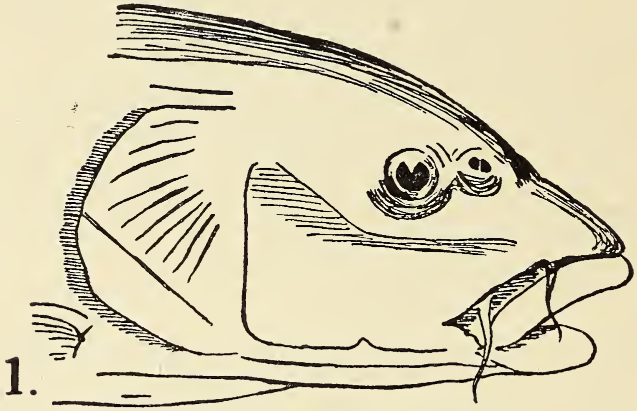


Fig. 1.—Head of Mahseer (dark variety) $\times\frac{1}{2}$. This is a thick-lipped specimen $\times\frac{1}{8}$.

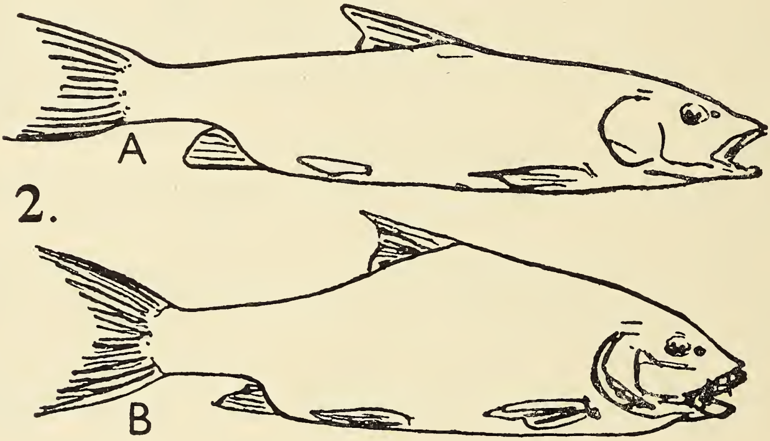


Fig. 2.—*A*. Outline of ordinary Mahseer, 8 lbs. *B*. Outline of dark variety; $8\frac{1}{2}$ lbs. $\times\frac{1}{8}$.
(*Journ. Darjeeling Nat. Hist. Society Vol. VI, No.* 2, *Oct.* 1931.)

The dark fish, or this specimen at any rate, was in shape far more like a *Katli* than a Mahseer. The fins were partly the yellow of the Mahseer and partly the slate colour of the *Katli*—the general colour of the fish was intermediate but the eye was golden, as in the Mahseer; only one spot on one iris was copper as in the Katli, but this may have been blood-shot. There were no tubercles on the upper lip.

[1]I do not remember to have seen this variety with thick lips before, and this is one of the reasons which makes me believe that this is a seasonal sexual change. My other reasons are:—

[2](1) That in fish which seem exactly alike in all other respects, the mouth parts of one may be swollen out of all proportion.

(2) That, I think but am not sure, I have only seen these thick-lipped fish caught late in the season from February onwards. O'Donel, however, says he has caught them in the Nunai River as early as November.

(3) That thick-lipped fish usually have a lot of red on the fins. This apparently does not apply to the dark variety.

[3]That the swelling is not uniform in different thick-lipped fish. The lips are always thickened but in some fish the swelling extends to the snout while in others it seems to affect the lower lip more, causing a sort of flap of flesh like an imperial. A still more pronounced type, which I have never seen myself, has these flaps apparently on both lips, as shown in one of the illustrations facing page 32 in Thomas' 'Rod in India'.

At present I feel that the distinction between what I have called 'Greyhound' and 'ordinary' Mahseer is a far less fundamental one than that between either of these varieties and the dark form—but possibly further observations, on the rivers, may cause me to change my opinion.

I should be very glad of the observations of other fishermen.

E. O. S.

[The head of a 'greyhound' type of fish may be seen on page 89, Vol. IV, No. 4 of this Journal.—Editor].

19. *Mahseer Fishing in the Bengal and Assam Dooars, by C. E. S. Fairweather, I.P. (Journ. Darjeeling Nat. Hist. Soc.*, Vol. VI, No. 4, April 1932).—Mahseer have no shaply defined spawning season like salmon and trout. They are, as the late H. S. Thomas (*'Rod in India'* by H. S. Thomas, I.C.S.) said, like the barnyard fowl: they lay their eggs a few at a time and they are never in better condition than when spawning or looking for an opportunity to spawn.[4] It is this search for spawning grounds that regulates our fishing seasons. Mahseer can be caught at any time of the year, provided one knows where they are to be found, but the other important proviso is that in order to catch them the condition of the river must be suitable. It is hardly of any use fishing for Mahseer

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[1] The 'Copper' variety have modified thick lips. See illustration in Burma chapter.

[2] This is the thick lip variety.

[3] I have taken some hundreds of these thick-lipped fish, in all sizes from ½ lb. to 40 lbs., and in every month from Feb. to Oct. from the Mahl River and Jhelum in the north-west along the Himalayas, through Nepal to Burma, but I have never yet seen one with so pronounced an adipose extension, as shown by Dr. Day's plate produced in the 'Rod in India.' The plate of the Thick lip Mahseer in the Burma Chapter is representative, and there is no 'flap' or adipose extension on the upper lip, at least I have never seen one. A. M.

[4] I disagree with Mr. Thomas that Mahseer are at their best while spawning. In late April and May in some rivers, when the main spawn begins, fish will be taken that offer no sport whatever. I say 'Main spawn', because all the varieties of fish are then found gravid.

(except with live bait) unless the water is clear—the clearer the better. Unless one can see the pebbles on the bottom in four feet of water, fishing for Mahseer is likely to be a heart-breaking business.[1] I refer of course to spinning for Mahseer.

The Mahseer, according to such observations as anglers have been able to make, apparently requires certain conditions for spawning.

(*a*) The water should be warmer than that of the usual glacier-fed river.

(*b*) The water should be shallowish and sheltered. In the big rivers like the Teesta, Sankos and Monas the water is cold, even in the plains, for a considerable distance below the gorges. These rivers begin to rise early in April when the snows melt; Mahseer which have found the shallow backwaters among the chars (miles below the gorge)—ideal places for spawning—now find the chars submerged and begin to move up towards the hills, where they find excellent spawning grounds in the various hill streams which have begun to flow again with the early rains. These small streams too are warm, coming off the hot sides of the lower ranges of hills. The fish apparently travel up these small streams to spawn when a spate comes down and drop back to the main river when the spate clears off.

The Teesta. The Mahseer hang about round the mouths of the Sevoke, Kalijhora, Reang and Gill Jhora, which run into the Teesta. There are perennial spawning places. As I said above, fish are there to be caught all the time. The difficulty is to find the water in proper trim. The Teesta itself is foul and unfishable from April until January or February and it remains clear only for a few weeks before the snow water again begins to come down. When, however, there is a break in the rains, the small hill streams clear and where they join the Teesta there is a belt of clear water for a considerable distance before it merges into the Teesta and gets 'sicklied over with the pale hue of chalk'. In this belt of clear water one can catch really good fish. It may happen that one gets a spell of rainless weather in July or August but one can never count on this. The best season therefore is from mid-September onwards, when the rains are beginning to stop and the hill streams are yet still fairly full and clear. The peculiar thing about these large rivers like the Teesta, Sankos and Monas is that away from the mouths of tributaries Mahseer are very hard to find. This is particularly the case with the Teesta but the Sankos and Monas, too, away from tributaries, are almost impregnable except under the most favourable conditions. The fish move upwards as soon as these rivers rise in April and move down again from the end of September. In the early season, March-April, the only mouth worth fishing is Reang. There is sufficient water here to keep the fish. In the September season they are good, *i.e.* there is enough clear and warm water flowing in the river to attract the spawning fish. As I said before, one can fish all the year on the Teesta but conditions from July to mid-

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[1] This has not been my experience, and I am inclined to agree with Mr. Martin, though clear water is of course the best,

September are so uncomfortable and uncertain that few people would care to bother: torrential rain, wet jungle, fever, leeches, etc. and the difficulty of choosing a time when the small stream is likely to clear. For those living at a distance this is impossible.

Fishing these tributary mouths is not very exciting. There is only one spot fishable, and generally out of 12 days fishing one has 5 or 6 blank days. When one gets a fish it is usually a good one and puts up a tremendous fight, aided by the full force of the Teesta current. No flimsy tackle is any good here. One needs almost 200 yards of line—'Y' stout Tiger traces and a stout rod and line. For rod a Hardy's, Murdoch or something similar is about right. Spoons up to 3″ or 4″ seem best, although I have seen some pretty sport on a Castle Connel Salmon rod—gut trace and fly spoon. This latter at Sevoke: at Reang and Kalijhora, however, one needs to hold the fish a bit harder. On a really good day, if two rods get 3 fish from the pool in the morning and perhaps one or two in the evening they have done very well indeed: next day they will probably come back from the river with nothing but a brace of backaches.

The Sankos. On the Sankos conditions are very much the same. There is a bund on the Sankos to the north east of Sankos Tea Estate, where a side stream comes in. Morning and evening one can get 2 or 3 fish and good fish too. About ½ mile below this spot a small overflow runs into the river again and here too a few fish can be had. I have however fished many other pools on the Sankos, where there is no tributary of warm water running in, without finding any traces of fish. Opposite Barabisha there is a tributary which comes in from the Assam side of the Sankos—some great catches have been recorded here, I believe.

The Monas. On the Monas my experience was the same. Away from the streams of warm water running into the big river, fishing seemed a mere waste of energy. Where, however, one did find a good spot with a 'run in', the fish seemed to lie about in shoals—large fish. It is however not much use trying to fish the Sankos or Monas before February unless one knows a place where a good stream of clear water runs in. These two rivers are also not so accessible as the Teesta.

[1]The ideal fishing conditions are:—

(1) A clear sky.
(2) No wind.
(3) Good clear water.

[2]Wind is the Mahseer fisherman's worst enemy. I attribute the difficulty of fishing these big rivers chiefly to the howling wind, which blows almost ceaselessly down or up the river day after day. On these rivers the wind starts generally about 9 or 10 a.m. and in the most favoured spots one should be on the water just after dawn.

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[1] For ideal conditions, yes!! I took the largest Mahseer I have caught (75 lbs.) during a thunder storm when a gale was blowing.

[2] This occurs in N. India and Burma, too, on the large rivers, but blows down stream in the morning and up stream in the evening. The days are quite often calm. It is known as the 'Dadu'.

The wind starts about 9 or 10 a.m. and does not drop till about 1½ hours before dusk. These last 1½ hours are generally good. From 10 a.m. till 3 p.m. one's best plan is to eat and sleep. To fish is mere waste of energy, as the fish seem to go right down the moment the wind starts.

It will be gathered from the foregoing that I am not particularly enamoured of these big rivers.

The most enjoyable fishing of all is in the smaller rivers like the Jaldaka, Torsa, Rydak, Champamati and the Aie. They all have their peculiarities but they have the advantage of being fishable from the gorges far down into the plains until sand and shingle give way to mud. One can fish with a light rod and fly spoon or use a medium rod—spinning reel and 2″ or 2½″ spoons, or both alternately, wandering down from pool to pool.

The Jaldaka and Torsa. The Jaldaka and Torsa have not fished well for years. This is due, I think, to excessive netting in the lower reaches and poaching in the higher reaches. The fish too are very shy. In the Jaldaka 'Catli' seem to predominate. The 'Catli' (Assam *Boka*.) is of the carp tribe, like the Mahseer. He has a smaller mouth and smaller scales, while the iris of his eye is red and not yellow like the Mahseer's. He takes a fly spoon well.

Some good fish have been taken at the junction of the Jaldaka and Murti above Ramshahi Hat. The Jaldaka was a famous river at one time but nowadays I would never make a special trip there to fish.

The Torsa is a fairly big river and does not clear properly before November. By that time the weather is getting too cold for the best fishing. When one is getting good Mahseer fishing, one is generally in a 'lather of sweat'. If one is not, then conditions are not at their best. The Torsa has not fished well from all accounts since it left its old bed, which runs past Madarihat Railway Station. I have not heard of any one making any good bags for a long time. Mr. Webb of Hasimara Tea Estate, I believe, catches good fish during the rains with a live bait picketed. Spinning of course is impossible at that time. The Torsa can be fished from either Madarihat or Nilpara Forest bungalows.

The Malang. At Nilpara there is a fascinating little stream called the Malangi, where one can have a really good time with a trout rod, fine gut trace and small fly spoons—fishing is not too easy, as the banks are heavily wooded. Surprising bags of fish up to 5 lbs. or over can be made.

The Rydak. The Rydak is one of the best streams I know. It can be fished from Bhutan Ghat (at the gorge), from Dumpara Ghat (on the Jainti-Kumargram Road) or farther down at Teamaree Ghat. It does not clear much before November but excellent fishing can be had from then onwards until the snow water comes down again in April. It holds very good fish up to 40 lbs.—fish of 7 to 10 lbs. are fairly common. In November-December-January, the reaches below Bhutan Ghat are better but when the river level falls in February, March, April, the best fishing is above Bhutan Ghat in the deep rocky pools of the gorge. One requires a medium spinning rod—the best spoon seems to be about 2 ins. or 2½ ins.

The movements of Mahseer in this river are fairly well known, owing to the fishing trap used by the Bhutias. Every year they put a slanting barricade across the river, which allows the water to get past gradually through the slats but keeps back all fish of any size. These soon find themselves at the end of the barrier, where the water is led on to a platform of split bamboo; there the fish are left high and dry. If they are not dry, then the Bhutias, who kill them in thousands, soon see that they are dried and taken up the hill for food. They intercept the fish in this way just after the rains when they are making their way down to the chars and other spawning places. Fortunately for the fish and for other fishermen it is not always possible for the Bhutias to get this trap across in time to intercept all or even most of the fish. Still, the destruction is immense and I consider that the Rydak is beginning to deteriorate rapidly. I cannot of course say how long this fish trap has been used by the Bhutias. This trap is called a 'teep' and there are two places where it is generally located—about 3 miles and 5 miles respectively above the boundary line. This trap, I am sure, has a lot to do with fishing conditions in the Rydak, which fluctuate astonishingly. On 'my last visit to the Rydak I found no trap at the lower site. I did not know then about the upper site. While I was fishing there a friendly Bhutia came along and told me that 'teep' had been fixed at a site higher up and that none of the big fish could get down below it. He offered to take me to some fine pools above the 'teep' and seemed to think that I was only wasting time below. The Rydak however will always get a certain number of fish from the Monas, into which it flows; the number of fish coming up depends a great deal on the angle at which it strikes the Monas, whether it runs in over shallows or whether it runs into the deep side of the Monas. As these conditions vary from year to year, this is another important reason for fluctuations in fishing conditions.

Till 1923 both channels of the Rydak joined at Teamaree Ghat but in that year the Eastern Channel thrust its way across country directly towards the Monas and threw up a large bank of shingle between itself and the Western Channel. Since then fishing has never been so good. Apparently the mouth of the Western Channel used to provide a better entry for fish. In 1923 the Western Channel almost dried up, so that fish which had dropped down must have found the entrance silted when they tried to get up again. There is a similar case to this in the Isla and the Tay in Scotland. The mouth of the Isla used to present a direct line to incoming salmon and sea trout, and many, if not most, of the fish used to go up the Isla in preference to the Tay.

The mouth of the Isla was then artificially altered, so that nowadays not more than one or two fish seem to enter the Isla.

The Champamati. Another delightful river as we proceed eastward is the Champamati. It is about half the size of the Rydak. It does not clear properly until Christmas. The best months are March and April. Mahseer up to 25 lbs. are caught now and again but the chief sport is got with 'Cutli', which in this river are the finest fighting fish I have met in India. At Ranikhata a 2 in. gold and silver spoon seems best but down below at Gorubasha an all silver 2½ in. spoon seemed to do best. The average for both Mahseer and 'Cutli' seems to run about 4 lbs. The 'Cutli' spin round at such a rate and twist up mounts and traces so badly that I had to contrive a mount attached to the spoon ring with a swivel. This seems the only effective way of dealing with these doughty fighters. The banks are heavily wooded, and casting is not always easy but some very fascinating fishing can be had with a light rod and fly spoons used with a dressed silk line. Hardy's 11 ft. 'Wye' rod (for Sea trout and small salmon) seems about right for this work. For spinning, the Corbett No. 1 rod is most suitable here.

The Aie. Still moving eastward one comes to the best river of all, the Aie, which provides about 30 miles of the most delightful fishing in a succession of runs and pools. The best of the fishing (about 14 miles) lies in the forest area from the gorge down to Burree Jahr. The water of this stream is distinctly warm. It clears almost invariably from mid-October or immediately the rains cease. It is almost impossible to have a blank day on this river. The fish are not very big—the biggest I have heard of are about 21 and 22 lbs. [Perrée caught a fish over 30 lbs. in a pool known as Perrée's pool *Editor*]. Later on I will give a few sample catches. The fishing is best in October-November before the cold winds start. If the rains are late one should fish the upper reaches in October-November, as the bigger fish are now down much more than 10 miles from the gorge by then. In February, March, April one must fish either near the gorge and above Dausri or well below Burree Jahr, as the river between Dausri and Burree Jahr disappears in the hot weather completely. Where one starts to fish this river in the hot weather two days spent exploring are not wasted, as owing to frequent changes of bed one can never be quite certain where one is to find the fish. This applies however to most of these Indian hill rivers.

Indian rivers have their good and bad days just like the more civilized streams of the West. All the fish seem to make up their minds at the same moment to stop biting. The theory is that this is due to some sudden deficiency of oxygen in the water. This deficiency may be due to several causes :—

(*a*) Low barometric pressure, which causes a sudden decrease of oxygen.

(*b*) A heavy fall of rain, which washes dead leaves and rotten vegetation into the river.

(*c*) Snow water, which drives out oxygen.

Lack of oxygen paralyses the fish and they simply lie still under stones on the bottom.

In such conditions Mahseer very often leave deep pools and go into the shallows, where the water rushing over boulders and pebbles is slightly aerated. They also lie right up under a waterfall. These observations are purely guess work and are meant only to provide some sort of Rule of Thumb to guide one to likely spots on a 'real bad day.'

When a wind is blowing it is no use fishing on wide wind-swept stretches of river—seek sheltered corners, if they are to be found. As one moves along from corner to corner one can pick up a fish here and there and can spot likely places when travelling up the river which one can fish when conditions are more promising.

Now as regards the kind of sport one can expect. I give below a few extracts from my records:—

Year	River	No. of days fishing	No. of fish caught	Total weight	Biggest fish	Dates
1919	Aie	23	154	406	20 lbs.	20.10 to 11.11
1920	Monas	19	18	203	37 lbs.	18.3 to 5.4
1921	Teesta	11	11	140	32 lbs.	6.10 to 16.10
1922	Teesta	15	29	179	21 lbs.	23.9 to 7.10
1923	Torsa	15	21	25	6 lbs.	13.10 to 27.10 Water not clear
,,	Rydak	7	33	133	26 lbs.	27.11 to 3.12
1924	Rydak	28	80	236	13 lbs.	(Various dates)
1925	,,	43	94	507	40 lbs 38 lbs.	19.2 to 14 .
1926	Aie	14	125	280	10 lbs.	24.10 to 5.11
1927	Aie	10	103	353	19 lbs. 9½ lbs.	6.11 to 15·11

Some 8 catches, which would be considered quite good days on the various rivers.

1919—Friday 31st October—Aie (Burree Jahr) 32 fish weighing 89½ lbs. and lot about 20 others.

1924—March (early)—Peddie's Catch—Aie (Hatishar).
(1) Ma —20-5-4-1½-1-1-¾-1¼-6-1½.
(2) ,, —22·21-3-3-3-1-¾.

1920—Thursday-March 1st—Monas—1 Mahseer—37
1 ,, —15
1 ,, —16
1 ,, — 5
1 ,, — 1
Total ... 5 ,, —74 lbs.

1920 Friday March 2nd—Monas
Mahseer—19-19-4½
Total 3 Fish = 42½ lbs.

1921—Sunday October 9th—Teesta (Reang)
Mahseer—16-14
Total 2 Fish = 30 lbs.

1922 Wednesday September 27th—Teesta (Sevoke)
Mahseer—2-4-6-3-1-3-6-4-2
Total 9 Fish = 31 lbs.

1922 Tuesday October 3rd—Teesta—2 hours fishing (Savoke) (afternoon)
Mahseer—18-8-3-2 = 4 fish = 31 lbs.

1923 November 28th—Rydak (Teamaree Ghat)
Mahseer—26-6½-6-4-3-2-1
Cutli—4-3½
Total 10 = 56 lbs.

1925 February 24th—Rydak (Bhutan) (Ghat)
Mahseer—40-38-6½
Cutli ... 3½
Total 4 = 88 lbs.

1927—February 23rd—Champamati [Gorubhasa]
Mahseer—9½-9-4-2-2 } 11 fish.
Cutli— 7-5-4-3-2-2 } 49½ lbs.

1927—November 3rd—Champamati [Gorubhasa]
Caught by Nelson—1 Cutli = 25 lbs.

[This is a specimen Cutli for this part of the world.]

River	Av. No. of fish caught per day	Av. weight of fish caught per day	Biggest
Aie	8	21	20, 17
Rydak	3	11½	40, 38, 26, 16
Teesta	1½	12	32, 24, 21
Monas	1	11¼	37, 21, 19, 19
Torsa	1½	1⅔	6 lbs.

Champamati—My figures not worked out. But in April 1926, 5 rods [Godden, Hulton, Bor, Brunbes, Burke] got 147 fish = 450 lbs. in 4 days. A.L. Godden himself got 67 = 220 lbs. in these 4 days on 73 Victor Rod with fly spoon.

Champati [A. L. Godden]—Best day 17 = 85¾ lbs.

20. *Note on Mr. Fairweather's Fishing Notes by O. M. Martin.* (*Journ. Darjeeling Nat. Hist. Soc.*, Vol. VI, No. 4, April 1932).—I don't agree that very clear water is necessary for Mahseer fishing. All the Mahseer I have caught in the autumn have been caught in water in which the pebbles could not be seen more than a foot deep. When the water got clearer than this, the Mahseer refused to bite. I caught one fish of 12½ lbs. on a spoon in *very muddy* water at Reang this October. I got two fish and lost another at Singla in water by no means clear in the same month. The water should be (1) warm and (2) not too muddy for the Mahseer to see the spoon.

I believe that the Mahseer in the cold weather start to take when the water temperature rises and that a sudden drop in water temperature puts them off their feed at any time of the year.

They also go off condition after spawning—as other fish do. They are in better condition in November than they are in October and are at their best in March-April—at least in the Teesta and Rungneet. They are so vigorous in March at Singla Bazaar that they will on occasion jump out of the water like salmon.

Darjeeling,
16-12-'31.

21. *Mr. Ritchie's Notes on Fishing on the Teesta River. Complete Summary of the Teesta River.* 1909-1930. (*Journ. Darjeeling Nat. Hist. Soc.*, Vol. VI, No. 1, June 1931).

Total fish caught	**Average weight per fish. (in lbs.)**
266 fish weighing 2,269¾ lbs., best fish 54 lbs.	8.5

Summary by Localities.

Rungneet-Teesta Bridge portion ...	6 fish	35¾ lbs.,	best	14¼ lbs.	5.9
Riyang Area	133 ,,	1,481½ ,,	,,	54 ,,	11.1
Kalijhora	13 ,,	142¼ ,,	,,	37 ,,	10.9
Sevoke	104 ,,	495¾ ,,	,,	14½ ,,	4.8
Duars and Jalpaiguri portion ...	10 ,,	114½ ,,	,,	45¼ ,,	11.4

Summary by Years.

1909.	4	fish	14	lbs.	best	7½	lbs.
1910.	1	,,	1½	,,			
1911.	3	,,	9	,,	,,	5	,,
1912.	1	,,	32	,,			
1913.	5	,,	19½	,,	,,	6	lbs.
1916.	1	,,	14½	,,			
1917.	2	,,	7¼	,,	,,	4½	lbs.
1918.	18	,,	115¼	,,	,,	14½	,,

								Average weight per fish
Summary by Years (*cont.*)								
1919.	46	fish	220¾	lbs.	best	29¾	lbs.	
1920.	7	,,	120½	,,	,,	38	,,	
1921.	47	,,	436¼	,,	,,	54	,,	
1922.	15	,,	160	,,	,,	33¾	,,	
1923.	35	,,	187¾	,,	,,	32	,,	
1924.	6	,,	28	,,	,,	24	,,	
1925.	26	,,	283¼	,,	,,	45¼	,,	
1926.	12	,,	86¼	,,	,,	18	,,	
1927.	6	,,	57¼	,,	,,	16½	,,	
1928.	10	,,	77½	,,	,,	36	,,	
1929.	8	,,	91½	,,	,,	18½	,,	
1930.	13	,,	307¾	,,	,,	39	,,	
Summary by Months.								
Jan.	4	fish	27½	lbs.	best	15½	lbs.	6.9
Feb.	17	,,	84¼	,,	,,	13½	,,	5.0
Mar.	40	,,	175¼	,,	,,	14½	,,	4.4
Apr.	33	,,	302½	,,	,,	45¼	,,	9.2
May	15	,,	246¾	,,	,,	38	,,	16.4
June	1	,,	5	,,				
July	3	,,	45½	,,	,,	21½	,,	15.1
Aug.	23	,,	202¼	,,	,,	54	,,	8.8
Sept.	47	,,	343¼	,,	,,	34½	,,	7.3
Oct.	65	,,	747	,,	,,	39	,,	11.5
Nov.	6	,,	39	,,	,,	11½	,,	6.5
Dec.	12	,,	51½	,,	,,	7	,,	4.3
Summary by Baits.								
Spoon ...	236	fish	1,649¼	lbs.	best	54	lbs.	7.0
Natural Bait ...	9	,,	156	,,	,,	40	,,	17.3
Artificial Baits ...	4	,,	71	,,	,,	35	,,	17.8
Atta ...	17	,,	393½	,,	,,	45¼	,,	23.2
Spoon Analysis.								
No. 3 or 1 in. size— all silver	3	fish	3	lbs.	best	1½	lbs.	1.0
No. 4 or 1¼ ins. size—								
all silver	5	fish	12¼	lbs.	best	8	lbs.	
brass and silver	6	,,	3¼	,,	,,	¾	,,	
	11	,,	15½	,,	,,	8	,,	1.4
No. 5 or 1½ ins. size—								
all silver	8	fish	18½	lbs.	best	4	lbs.	
brass and silver	24	,,	71¾	,,	,,	9¾	,,	
silver and brass	4	,,	20½	,,	,,	12½	,,	
	36	,,	110¾	,,	,,	12½	,,	3.1
No. 5½ or 1⅝ ins. size—								
all silver	3	fish	28½	lbs.	best	14½	lbs.	
brass and silver	9	,,	28¾	,,	,,	13	,,	
	12	,,	57¼	,,	,,	14½	,,	4.8
No. 6 or 1¾ ins. size—								
all silver	14	fish	77½	lbs.	best	12½	lbs.	
brass and silver	2	,,	17¼	,,	,,	12	,,	
silver and brass	1	,,	11½	,,				
	17	,,	106¼	,,	,,	12½	,,	6.3
No. 7 or 2 ins. size—								
silver and brass	8	fish	47¼	lbs.	best	14¼	lbs.	
all silver	3	,,	5¼	,,	,,	2¼	,,	
copper and silver	14	,,	61¾	,,	,,	7	,,	
	25	,,	114¼	,,	,,	14¼	,.	4.6

Spoon Analysis (*cont.*)					**Average weight per fish.**
No. 7½ or 2¼ ins. size—					
silver-scaled and copper ...	2 fish	23¼ lbs.	best	14¼ lbs.	11.6
No. 8 or 2½ size—					
all silver	54 fish	498½ lbs.	best	38 lbs.	
silver-scaled and copper ...	15 ,,	173 ,,	,,	54 ,,	
silver and copper	4 ,,	29½ ,,	,,	14 ,,	
brass and silver	14 ,,	95¼ ,,	,,	25 ,,	
silver and brass	10 ,,	57¾ ,,	,,	11½ ,,	
brass-scaled and silver ...	2 ,,	5½ ,,	,,	4 ,,	
	99 ,,	859½ ,,	,,	54 ,,	8.7
No. 8½ or 2¾ ins. size—					
all silver	5 fish	45½ lbs.	best	18 lbs.	11.1
No. 9 or 3 ins. size—					
all silver	5 fish	23¾ lbs.	best	9 lbs.	
silver and brass	4 ,,	31¾ ,,	,,	14 ,,	
brass and silver	1 ,,	5½ ,,			
silver-scaled and copper ...	3 ,,	70 ,,	,,	37 ,,	
	13 ,,	131 ,,	,,	37 ,,	10.1
No. 10 or 3½ ins. size—					
silver and brass	7 fish	146¾ lbs.	best	38 lbs.	
all silver	3 ,,	9 ,,	,,	5 ,,	
	10 ,,	155 ,,	,,	38 ,,	15·6
No. 11 or 4 ins. size—					
all silver	1 fish	¾ lb.			
all scarlet	2 ,,	26½ ,,	best	21½ lbs.	
	3 ,,	27¼ ,,	,,	21½ ,,	9.9

Spoon Summary.

Light spoons, Nos. 3 to 7 ...	104 fish	407 lbs.	best	14½ lbs.	3.9
Heavy spoons, Nos. 7½ to 11 ...	132 ,,	1,242¼ ,,	,,	54 ,,	10.2

Best Days.

Oct.	10, 1930.	Riyang.	2	fish of 31 and 24 lbs.
Aug.	23, 1921.	,,	1	,, 54 lbs.
Oct.	8, 1930.	,,	2	,, 35 and 12½ lbs.
April	4, 1925.	Jalpaiguri.	1	,, 45¼ lbs.
Dec.	8, 1925.	Sevoke.	8	,, 41 lbs. best 7 lbs.
Oct.	14, 1928.	Riyang.	2	,, 36 and 5 lbs.
Oct.	12, 1930.	,,	2	,, 24½ and 15½ lbs.
Oct.	6, 1930.	,,	1	,, 39 lbs.

Recent Fishing.

Result of a month's fishing at Riyang, September 15th to October 14, 1930.
13 fish weighing 307¾ lbs.. best fish 39 lbs.
Average weight per diem 10.6 lbs.
Average weight per fish 23.7 lbs.
Total fish hooked—31, or an average of about one per diem.
Number of fish lost—18.
Number of absolutely blank days (no sign)—7.
Best day—55 lbs. (24 and 31). Next best—47½ lbs. (12½ and 35.)
Maximum number of fish hooked
on any one day (not mere rises)—3.

Large Mahseer. Altogether 42 fish of 15 lbs. and over were taken, *viz.*, 54, 45¼, 39, 38, 37, 36, 35, 34½, 33¾, 33½, 32, 32, 31, 30¾, 29¾, 28, 24½, 24, 24, 23, 23, 21½, 20, 20, 19¾, 19¼, 19, 18½, 18½, 18, 18, 18, 16½, 16½, 16, 16, 15¾, 15½, 15½, 15¼, 15 & 15. Of these two (45¼ & 32) were caught at Jalpaiguri and Barnes Ghat, and two (37 & 18) at Kalijhora. The rest were all caught at Riyang.

As regards localities for large fish, Riyang is certainly the best. There are perhaps larger fish at the Rungeet junction, but they are not there at the time the water is clear, at least I have never done any good at that time. In the spring when the water is still clear the fish have not yet come up from below, and by the time the water has cleared in the autumn the fish have passed down. The Rungeet is similar to the Teesta and remains permanently dirty during the high water season. I think it likely that anyone trying this spot in May, June, August and September with atta or live-bait would stand a good chance of booking some enormous fish. The water would always be too dirty for spinning at that time. Heat and rain are also further drawbacks. Nevertheless I believe the biggest fish in the river are to be had there at that time.

Large Mahseer may be occasionally taken at Kalijhora in the autumn, and also at Sevoke in September, but at the latter place it is then impossible to follow the fish down the bank and anything over 15 lbs. will usually clear the reel out and break away. I have been broken at Sevoke in September many times and never succeeded in landing anything big there. Large Mahseer may also be taken on atta at Jalpaiguri and Barnes Ghat during April and the first week in May, and smaller fish at other times. I have never tried there during the autumn.

It is not much use trying for large fish in the hill section of the river during the clear water season. The best fishing is at the mouths of the tributaries when the Teesta itself is dirty and there is a sufficient head of water in the tributary to give a good stretch of clear water in the Teesta below the mouth of the tributary. Large Mahseer should be sought when they are passing down in the autumn, and the largest fish are the last to pass up but the first to pass down. Late spring and early autumn are therefore the best times for big fish.

Summary of Light and Heavy Fishing

					Average weight per fish
Fish under 15 lbs.	224 fish	1,214¼ lbs.	best 14½ lbs.	...	... 5.4
Fish of 15 ,, and over.	42 ,,	1,055½ ,,	,, 54 ,,	...	... 25.1

Summary of the Rungeet-Teesta Bridge portion of the Teesta River, 1909–1929

					Average weight per fish
Total Caught					
6 fish weighing 35¾ lbs. best fish 14¼ lbs.				... ...	... 5.9
By Localities					
Rungeet River.	3 fish	28 lbs.	best 14¼ lbs.	...	... 9.3
,, Junction.	2 ,,	5 ,,	,, 3½ ,,	...	... 2.5
Teesta Bridge.	1 ,,	2¾ ,,			

By Years

1909.	1	fish of	2¾ lbs.
1918.	1	,, ,,	3½ ,,
1919.	1	,, ,,	12 ,,
1921.	1	,, ,,	1¾ ,,
1923.	1	,, ,,	1½ ,,
1929.	1	,, ,,	14¼ ,,

						Average weight per fish
By Months						
March.	4	fish	20¼ lbs.	best	14¼ lbs.	5.1
April.	1	,,	12 ,,			
November.	1	,,	3½ ,,			
By Baits						
Spoon	5	fish	33 lbs.	best	14¼ lbs.	6.6
Atta	1	,,	2¾ ,,			

Spoon Analysis

No. 5 or 1½ in. size—silver and brass	1 fish of	1¾ lbs.	
No. 7 or 2½ ins. size—silver-scaled and copper	1 ,, ,,	14¼ lbs.	
No. 8 or 2½ ins. size—all silver	2 ,, ,,	12 and 3½ lbs.	7.8
No. 9 or 3 ins. size	1 ,, ,,	1½ lbs.	

Best Days

March 16	1929.	1 fish of	14¼ lbs.
April 19	1919.	1 ,, ,,	12 ,,

Large Mahseer

None.

Summary of the Riyang area of the Teesta River 1918–1930

	Average weight per fish
Total Caught	
133 fish weighing 1,481½ lbs. best fish 54 lbs.	11.1

By Years

1918.	2	fish	13	lbs.	best	7½	lbs.
1919.	24	,,	122½	,,	,,	29¾	,,
1920.	4	,,	102½	,,	,,	38	,,
1921.	31	,,	358½	,,	,,	54	,,
1922.	13	,,	146½	,,	,,	33¾	,,
1923.	23	,,	146	,,	,,	32	,,
1924.	1	,,	24	,,			
1925.	4	,,	77½	,,	,,	40	,,
1926.	4	,,	34¼	,,	,,	18	,,
1927.	6	,,	57¼	,,	,,	16½	,,
1928.	5	,,	56½	,,	,,	36	,,
1929.	3	,,	32¼	,,	,,	18½	,,
1930.	13	,,	307¾	,,	,,	39	,,

By Months

Jan.	2	fish	17¼	lbs.	best	15½	,,	8.6
Feb.	2	,,	7	,,	,,	5	,,	3·5
Mar.	21	,,	98¼	,,	,,	14¼	,,	4·7
Apl.	26	,,	177½	,,	,,	32	,,	6·8
May	15	,,	246¾	,,	,,	38	,,	16·4
June	1	,,	5	,,				
July	1	,,	21½	,,				
Aug.	6	,,	116¼	,,	,,	54	,,	19·4
Sept.	16	,,	208¼	,,	,,	34½	,,	13·0
Oct.	43	,,	583¾	,,	,,	39	,,	13·6

By Localities

Gil Jhora Mouth.	3	fish	23¾	lbs.	best	14¾	lbs.	7.9
Rilli Mouth.	6	,,	13¼	,,	,,	4¼	,,	2.2
Riyang River.	14	,,	19¼	,,	,,	8	,,	1.4
Riyang Mouth. Area	97	,,	1141½	,,	,,	54	,,	11·8

				Average weight per fish.
Lower Pool and Reach.	12 fish	274¾ lbs.	best 39 lbs.	22.9
Timber Pool near 21st mile.	1 ,,	9 ,,		

By Baits

Spoon	112 fish	980 lbs.	best 54 lbs.	8.8
Natural Bait	8 ,,	151½ ,,	,, 40 ,,	18.9
Artificial Bait.	3 ,,	64 ,,	,, 35 ,,	21.3
Atta	10 ,,	286 ,,	,, 39 ,,	28.6

Recent Fishing

Please see third page.

Spoon Analysis

No. 3 or 1 in. size—all silver	1 fish	of ½ lb.		
No. 4 or 1¼ ins. size—				
all silver	3 fish	10¼ lbs.	best 8 lbs.	
brass and silver	6 ,,	3¼ ,,	,, ¾ ,,	
	9 ,,	13½ ,,	,, 8 ,,	1.5
No. 5 or 1½ ins. size—				
all silver	1 ,,	of ½ lb.		
brass and silver	13 ,,	,, 45¼ ,,	best 9¾ lbs.	
	14 ,,	,, 45¾ ,,	,, 9¾ ,,	3.3
No. 5½ or 1⅝ ins. size—				
brass and silver	2 fish	5¼ lbs.	best 4½ lbs.	
all silver	1 ,,	½ ,,		
	3 ,,	5¾ ,,	,, 4½	1.9
No. 6 or 1¾ ins. size	1 ,,	of ½ b.		
No. 7 or 2 ins. size—silver and brass	7 fish	40¾ lbs.	best 14¼ lbs.	5.8
No. 8 or 2½ ins. size—				
all silver	36 fish	401¾ lbs.	best 38 lbs.	
silver-scaled and copper	12 ,,	151¾ ,,	,, 54 ,,	
silver and copper	3 ,,	18½ ,,	,, 14 ,,	
brass and silver	9 ,,	68¾ ,,	,, 25 ,,	
silver and brass	2 ,,	7 ,,	,, 6¼ ,,	
	62 ,,	647¾ ,,	,, 54 ,,	10.4
No. 9 or 3 ins. size—				
all silver	2 fish	13 lbs.	best 9 lbs.	
silver and brass	1 ,,	¾ ,,		
brass and silver	1 ,,	5½ ,,		
silver-scaled and copper	2 ,,	33 ,,	,, 23 ,,	
	6 ,,	52¼ ,,	,, 23 ,,	8.8
No. 10 or 3½ ins. size—silver and brass	7 fish	146¾ lbs.	best 38 lbs.	21.0
No. 11 or 4 ins. size—all scarlet	2 ,,	26½ ,,	,, 12½ ,,	13.3

Best Days

Oct. 10,	1930.	2 fish	of 31 and 24 lbs.
Aug. 23,	1921.	1 ,,	,, 54 lbs.
Oct. 8,	1930.	2 ,,	,, 35 and 12½ ,,
Oct. 14,	1928.	2 ,,	,, 36 and 5 ,,
Oct. 12,	1930.	2 ,,	,, 24½ and 15½ ,,

Summary of the Riyang Area of the Teesta River. 1918-1930.

Large Mahseer. Altogether 38 Mahseer of 15 lbs. and over were taken, *viz.*, 54, 39, 38, 36, 35, 34½, 33¾, 33½, 32, 31, 30¾, 29¾, 28, 24½, 24, 24, 23, 23, 21½, 20, 20, 19¾, 19¼, 19, 18½, 18, 18, 16½, 16½, 16, 16, 15¾, 15½, 15½, 15¼, 15 & 15.

The best times of the year for large Mahseer are from the middle of April to the middle of May, when the fish are passing up, and again from the middle of September to the middle of October when they are passing down, and the autumn fishing is decidedly the better of the two. I have had no recent experience of the spring fishing, but there is not much water in the tributary at that time and it is soon eaten up by the Teesta. In the old days there was a good deep pool and run at the mouth, but with the present choked-up mouth it is doubtful whether there would be sufficient clear water in the Teesta, the Teesta itself at that time being dirty. The 54-lber. caught in August was a stray fish and should not be taken as a guide.

The time taken in landing most of these large fish was very much under the regulation time of a minute to the pound. This is usually the case at Riyang, where large Mahseer do not put up the fight that might be expected of them. There is, however, one time in the year when exactly the opposite is the case, and that is during the latter half of September, when the very largest fish appear to be on the move and the water is still high and current swift. Anyone hooking a fish of 30 lbs. and upwards at that time will find it quite the exception to land it. Even an experienced hand will lose two out of three. The beginner has absolutely no chance. I lost quite a number of fish at this time this year (1930), and on one occasion had a fish on for exactly an hour (16-20 to 17-20 on the 23rd Sept.), which took me quite a long way downstream, when the hook broke on my attempting to put on a greater strain, not being able to follow any further, and not having up to then made any apparent impression on the fish. During the whole of that time I never once saw the fish, although I was most of the time opposite and slightly below him, so that he was fighting a very strong current in addition to my pull on him. In September, 1921, I also lost a number of very large fish and had the almost identical experience of having one on for exactly an hour. The period referred to above lasts about a week and occurs in the latter half of September when the water is still high. Once the water falls, a marked change takes place and matters go from one extreme to the other, quite large fish being landed in a disappointingly short time.

Seasons. It should be remembered that this is the hill section of a river, and the fish are mostly 'travellers', Riyang being merely a port of call on their annual voyage up and down the river for spawning purposes. They pass up in the spring during the period when the river begins to permanently rise till the rains are well established; and they pass down again in the autumn during the period when the rains begin to break up till the river has permanently settled after the rains. In the height of the monsoon they are mostly as high up the hill as they can get, and in the middle of the dry season they are mostly in the rapids and pools clear of the hills. It is therefore not much use starting to fish in the spring till the river has become well disturbed from its dry season setting and begun to permanently rise or continuing to fish in the autumn once the river has permanently fallen and become settled. It is also not much use fishing in the height of the monsoon, or in the middle of the dry season. Fish may occasionally be caught at these periods, but such are not the 'seasons' for the locality.

Reflection on these facts should dispel the not uncommon fallacy that it is no use B fishing one day because A has 'cleaned the place out' the previous day. A fresh lot of fish may have arrived. In fact it will be found that even when the fish are most on the move there are days on which there are practically no fish about. The reason is that those that were there have moved on while a fresh lot have not yet arrived.

In the dry season, however, when the fish have settled in localities mostly clear of the hills for their dry season home, it is of course different. One man can 'clean the place out' for another who follows.

As I have stated elsewhere in these notes the largest Mahseer are the last to pass up in the spring but the first to pass down in the autumn, and the best times for really big fish are therefore late spring and early autumn. Anyone who is keen on beating my 54-lbs. at Riyang is advised to try, either as late in the spring as the conditions will permit (the very end of the spring run is the time) or as early in the autumn as the fish first begin to appear (the very start of the autumn run is the time.) These periods vary a bit with the season. The former is seldom before the first week in May and may even run into the beginning of June. The latter is almost always in September, seldom before the middle of the month, and usually about the third week. As I have said before, the 54-lber. caught in August was a stray fish, which is clear from the fact that it was a female fish with roe and therefore still going up to spawn, and not an autumn fish returning.

Summary of Fishing at Kalijhora Teesta River. 1909–1925

Total Caught	**Average weight per fish.**
13 fish weighing 142¼ lbs. best fish 37 lbs.	10.9

By Years

1909.	2	fish	10½	lbs.	best	7½	lbs.
1916.	1	,,	14½	,,			
1918.	1	,,	11½	,,			
1919.	1	,,	3½	,,			
1921.	4	,,	26¼	,,	,,	12	,,
1925.	4	,,	76	,,	,,	37	,,

By Months

Mar.	4	fish	28½	lbs.	best	14½	lbs.	7.1
Aug.	4	,,	26¼	,,	,,	12	,,	6.3
Oct.	4	,,	76	,,	,,	37	,,	19.0
Nov.	1	,,	11½	,,				

By Baits

All on spoon.

Spoon Analysis

No. 6 or 1¾ ins. size— brass and silver	1	fish	of 12	lbs.				
No. 8 or 2½ ins. size—								
all silver	5	fish	40	lbs.	best	14½	lbs	
brass and silver	2	,,	10¼	,,	,,	6	,,	
silver-scaled and copper ...	2	,,	17	,,	,,	13	,,	
	9	,,	67¼	,,	,,	4½	,,	7.4

		Average weight per fish
No. 8½ or 2¾ ins. size— all silver	2 fish 26 lbs. best 18 lbs.	13,0
No. 9 or 3 ins. size— silver-scaled and copper ...	1 fish of 37 lbs.	

Best Days

Oct.	3,	1925	1 fish of 37 lbs.
Oct.	1,	1925	1 ,, ,, 18 ,,

Large Mahseer

Two fish of 37 and 18 lbs.

Summary of Fishing at Sevoke, Teesta River. 1913-1929

Total Caught

	Average weight per fish
104 fish weighing 495¾ lbs. best fish 14½ lbs.	4.8

By Years

1913.	3	fish	7½	lbs.	best	4	lbs.
1917.	2	,,	7¼	,,	,,	4½	,,
1918.	14	,,	87¼	,,	,,	14½	,,
1919.	20	,,	82¾	,,	,,	12½	,,
1920.	3	,,	18	,,	,,	13½	,,
1921.	11	,,	40¾	,,	,,	13	,,
1922.	2	,,	13½	,,	,,	9¼	,,
1923.	11	,,	40¼	,,	,,	7¼	,,
1924.	5	,,	4	,,	,,	1¼	,,
1925.	17	,,	84½	,,	,,	13½	,,
1926.	7	,,	38	,,	,,	9	,,
1928.	5	,,	18	,,	,,	6	,,
1929.	4	,,	45	,,	,,	14	,,

By Months

Jan.	2	fish	10¼	lbs.	best	6¼	lbs.	5.1
Feb.	14	,,	71¼	,,	,,	13½	,,	5.1
Mar.	5	,,	11	,,	,,	4	,,	2.2
Apl.	3	,,	21¾	,,	,,	11½	,,	7.2
July	2	,,	24	,,	,,	13	,,	12.0
Aug.	13	,,	59¾	,,	,,	13½	,,	4.6
Sept.	31	,,	135	,,	,,	14	,,	4.4
Oct.	18	,,	87¼	,,	,,	14½	,,	4.5
Nov.	4	,,	24	,,	,,	9	,,	6.0
Dec.	12	,,	51	,,	,,	7	,,	4.3

By Baits

Spoon	102 fish 484¼ lbs. best 14½ lbs.	4.7
Natural Bait	1 ,, 4½ ,,	
Artificial Baits	1 ,, 7 ,,	

Spoon Analysis

No. 3 or 1 in. size—								
all silver	2	fish	2½	lbs.	best	1½	lbs.	1.3
No. 4 or 1¼ ins. size—								
all silver	2	fish	2	lbs.	best	1¼	lbs.	1.0
No. 5 or 1½ ins. size—								
all silver	7	fish	18	lbs.	best	4	lbs.	
silver and brass	3	,,	18¾	,,	,,	12½	,,	
brass and silver	11	,,	26½	,,	,,	8	,,	
	21	,,	63¼	,,	,,	12½	,,	3.0

				Average weight per fish
No. 5½ or 1⅝ ins. size—				
all silver	2 fish	28 lbs.	best 14½ lbs.	
brass and silver	7 ,,	23½ ,,	,, 13 ,,	
	9 ,,	51½ ,,	,, 14½ ,,	5.7
No. 6 or 1¾ ins. size—				
all silver	13 fish	77 lbs.	best 12½ lbs.	
silver and brass	1 ,,	11½ ,,		
brass and silver	1 ,,	5¼ ,,		
	15 ,,	93¾ ,,	,, 12½ ,,	6.2
No. 7 or 2 ins. size—				
all silver	3 fish	5¼ lbs.	best 2½ lbs.	
silver and brass	1 ,,	6½ ,,		
copper and silver	14 ,,	61¾ ,,	,, 7 ,,	
	18 ,,	73½ ,,	,, 7 ,,	4.1
No. 7½ or 2¼ ins. size—				
silver-scaled and copper ...	1 fish of 9 lbs.			
No. 8 or 2½ ins. size—				
all silver	11 fish	41¼ lbs.	best 10 lbs.	..
silver and brass	8 ,,	50¾ ,,	,, 11½ ,,	
silver and copper	1 ,,	11 ,,		
silver-scaled and copper ..	1 ,,	4¼ ,,		
brass and silver	3 ,,	16¼ ,,	,, 9¼ ,,	
brass-scaled and silver	2 ,,	5½ ,,	,, 4 ,,	
	26 ,,	129 ,,	,, 11½ ,,	5.0
No. 8½ or 2¾ ins. size—				
all silver	3 fish	19½ lbs.	best 13½ lbs	6.5
No. 9 or 3 in. size—				
all silver	2 fish	9¼ lbs.	best 7¼ lbs.	
silver and brass	3 ,,	31 ,,	,, 14 ,,	
	5 ,,	40¼ ,,	,, 14 ,,	8.0

Best Days

Dec. 8, 1925 ...	8 fish	41 lbs.	best 7 lbs.
Aug. 18, 1929 ...	3 ,,	31 ,,	,, 11½ ,,
Oct. 12, 1918 ...	2 ,,	25½ ,,	,, 14½ ,,
Sept. 29, 1918 ...	2 ,,	24½ ,,	,, 12½ ,,

Large Mahseer

None were landed. These fish are usually on the move in the autumn, when the Teesta is high and the fishing is all at the mouth of the Sevoke river and just below. At the end of the run there is a heavy rapid in the Teesta and a crumbling bank, full of snags and covered with jungle. A fish of 15 lbs. and over will usually be able to get into this rapid, when it clears the reel out and breaks away, it being impossible to follow down the bank. I was broken some six or eight times in this way and never succeeded in landing any fish of 15 lbs. and over.

The mouth of the tributary in the autumn of 1930 was much higher up the Teesta than it has been for many years and there is now much more room below the mouth for landing fish, but I did not fish at Sevoke in 1930.

Summary of the Duars and Jalpaiguri portion of the Teesta River. *1909–1926.*

Total Caught

	Average weight per fish
10 fish weighing 114½ lbs, best fish 45¼ lbs. ...	... 11·4

		Arrange weight per fish
By Localities		
Phulbarrie Ferry	3 fish 9 lbs. best 5 lbs.	3.0
Neora Junction	1 ,, 6 ,,	
Barnes Ghat	3 ,, 52 ,, ,, 32 ,,	17.0
Jalpaiguri Ghat	3 ,, 47½ ,, ,, 45¼ ,,	15.0
By Years		
1909	1 fish of ¾ lb.	
1910	1 ,, ,, 1½ lbs.	
1911	3 ,, ,, 9 ,, best 5 lbs.	
1912	1 ,, ,, 32 ,,	
1925	1 ,, ,, 45¼ ,,	
1926	1 ,, ,, 14 ,,	
1913	2 ,, ,, 12 ,, ,, 6 ,,	
By Months		
Feb.	1 fish of 6 lbs.	
Mar.	6 ,, ,, 17¼ ,, best 6 lbs.	2·9
Apl.	3 ,, ,, 91¼ ,, ,, 45¼ ,,	30.4
By Baits		
Spoon	4 fish of 9¾ lbs. best 5 lbs.	2.4
Atta	6 ,, ,, 104¾ ,, ,, 45¼ ,,	17.5
Spoon Analysis		
No. 10 or 3½ ins. size—all silver	3 fish of 9 lbs. best 5 lbs.	3.0
No. 11 or 4 ins. size—all silver	1 fish of ¾ lb.	
Best Days		
April 5, 1925	1 fish of 45¼ lbs.	
April 30, 1912	1 ,, ,, 32 ,,	

Large Mahseer

Two fish of 45¼ and 32 lbs.

(To be continued)

NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

VIII—BY TANK AND JHIL.

(*With 12 plates from photographs by the author*).

(*Continued from page* 401 *of Vol.* xliii. *No.* 3).

A tank or pond, formed by the earth having been removed to make the homes of the simple folk that constitute the majority of India's four hundred millions, occurs on the outskirts of many a village throughout the length and breadth of the land. Overlooking these tanks one or more large trees frequently have their roots—generally *pipal, banyan, tamarind* or *nim*. To these, often, a number of species of birds resort for nesting purposes, as soon as the south-west monsoon breaks, towards the end of June. Where one village gives sanctuary to openbill storks, with, perhaps, some cattle egrets and pond herons nesting on a neighbouring tree, another is favoured only by white ibises, while a third may act as host to one or two pairs of grey herons and darters, and a few spoonbills. A fourth, again, may have its trees tenanted by a number of species, including little cormorants, little and lesser egrets and, later, a considerable colony of painted storks.

It is at 'heronries' such as I have described that my observations have been made and my photographs taken; and if these miniature heronries lack the grandeur of such famous waterfowl breeding haunts as the Keoladeo Ghaña in Bharatpur State, they possess this advantage that the observer, having fewer species before him, is in a better position to watch each more closely than might be the case if there were several. Withal he will find that he has not a single dull moment, that something is happening the whole time, whether he be studying the birds with field glasses from the comfortable ease of a *charpoy* kindly produced for his special benefit by some villager, or photographing them from the shelter of a *hide*.

But let us go back a little; let us try and obtain a picture of what the Indian plains look like, *feel* like, at this season of the year; of how the average mortal fares.

It has been a real 'corker' of a hot weather and the maximum shade temperature recorded 122.6 degrees. At times the *loo*—the burning, scorching wind so dreaded in the United Provinces—has blown throughout the night as well as during the long hours of daylight. Indians have been going about with cloths to their faces, mouth, ears and nose stuffed up so that the heat shall not enter into their bodies. No wonder the oldest resident is said to have remarked that he had not known a hot weather like unto this during the fifty-five years he has lived in our station. The countryside is as bare and brown as can be; not a blade of grass for the painfully lean kine, many of which succumb to these famine conditions. Ponds and *jhils* have long since dried up and a number of sarus cranes whose beats are familiar to us, have betaken themselves elsewhere, possibly to the river's margin; there, I fear, to eke out a frugal living. Other marsh birds also are absent from their wonted haunts. Man too has been hard put to it and many a good soul—European as well as Indian—has been removed from our midst by the Great Reaper.

We tell ourselves this cruel heat cannot last; we look forward with the keenest anticipation to the 25th of June when (so the Old Stagers say) the monsoon may be expected to break. At last, when we are at the extreme end of our tether, clouds gather, and on the 24th afternoon the rain comes down in buckets and continues to do so till the late evening. (The Old 'Uns knew what they were talking about, after all). For the next two days we are treated to real monsoon weather and where before the countryside looked the abomination of desolation, everything is now a lovely, fresh green, and the new-grown grass soon provides luscious keep to starving cattle. Man no longer suffers the tortures of prickly heat as he did a few days ago, and once more is fit to apply himself with zeal to 'the daily round, the common task'. The altered weather conditions have not passed unnoticed by the feathered world either—even in our gardens a marked change is at once noted. Where previously the ashy wren-warbler slid about quietly in the bushes, he now proclaims his presence; and there is a ring in his notes which suggests the joy of living. Tailor birds *to-weet-to-weet* louder than ever, and pied mynahs add their cheerful notes to the bird chorus. The house crow more than any other species hails with unalloyed delight the advent of the monsoon. At once he and his mate have busied themselves with domestic duties and on all sides now their stick nests are to be seen.

But it is not of garden birds I would write: let us instead visit one of the heronries described earlier, one that has been in existence for years and was referred to many decades back in Hume's *Nests and Eggs of Indian Birds*. It is occupied entirely by white ibises, of which there cannot be less than one hundred pairs in residence. But the 'mighty tamarind tree' of which Major Bingham wrote, no longer exists. We are told it was blown down twenty-five or thirty years ago, since when the white ibis have made their nests on two *pipal* trees on either side of the Grand Trunk road, on the outskirts of the village: such is the attachment of this species to an old breeding haunt. We learn also that the tree in question was used by these birds for nesting purposes right up to the end and that it crashed in the cold weather when the ibis were no longer concerned with family cares: which was fortunate, as if they had been nesting at the time the probability is that this village would have been abandoned by the birds as a breeding haunt.

Before we reach our 'ibisery' we know we must be in the neighbourhood of one because numbers of birds fly across our

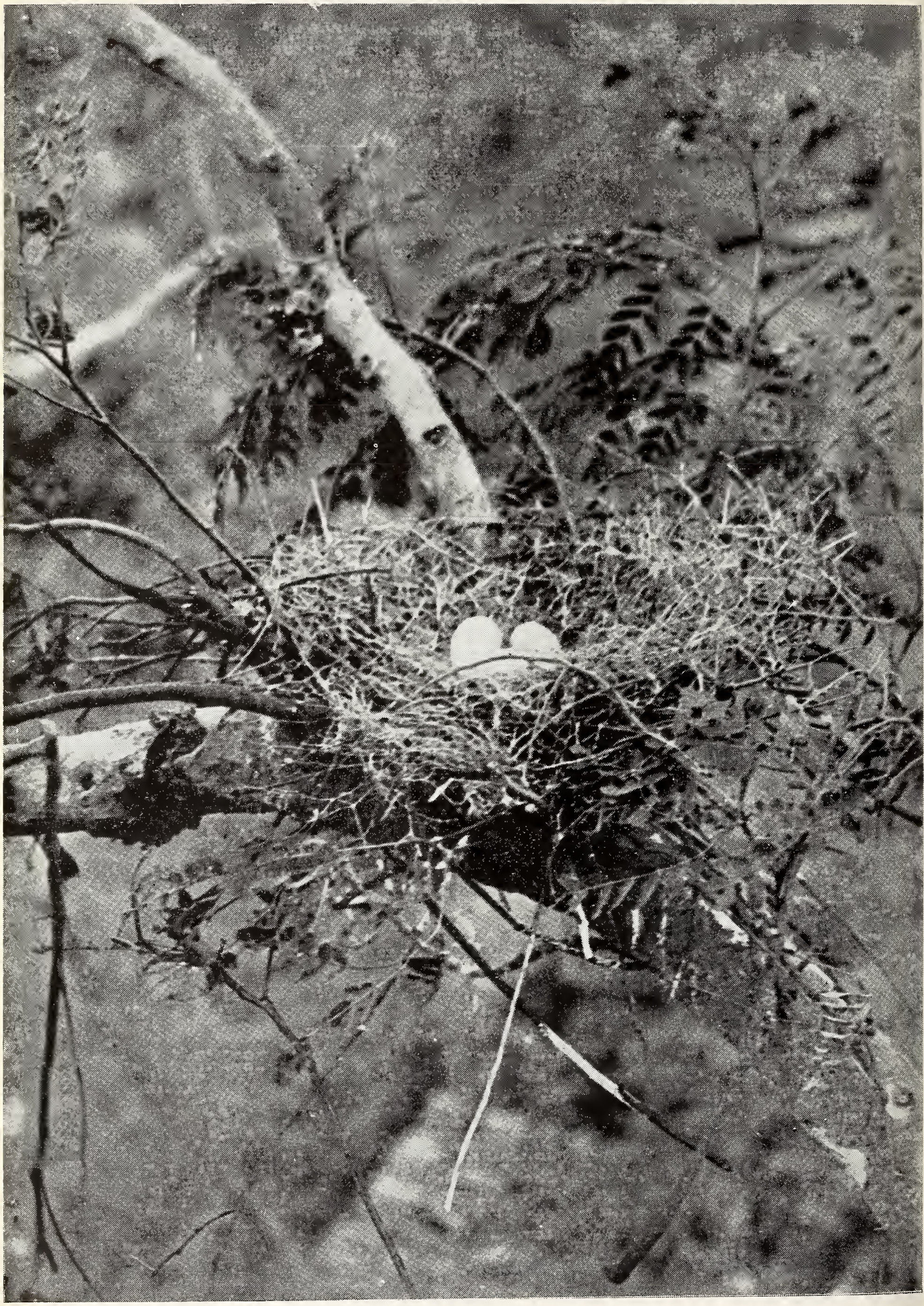


Photo by *E. H. N. Lowther*

Nest of the Indian Black Ibis.
Pseudibis papillosus Temm.
88' above ground.

field of vision with twigs in their beaks. On arrival at the site we find that although nesting operations are well in hand not a single ibis is sitting on eggs. We note that the fine sticks or twigs with which the nests are being made, are almost always brought in by one bird—from some distance too, methinks, as they are from *babool* trees, of which there is not an example within a considerable radius of the village—while the other remains at the nest, to incorporate each addition in the structure. *Very rarely* both birds bring materials to the nest; even then only one seems to be concerned actively with its construction. The majority of nests are in the most exposed parts of the tree, open to the sky; quite a few, however, rest on the lower branches, and are therefore more sheltered.

When next we visit the breeding colony we do not see a single pair of ibises engaged on nest construction. On every nest—they are small for the side of the bird, about ten inches in diameter—the females are now sitting hard, their mates often besides them, but absent in the majority of cases, the loose skin below the chin vibrating at an alarming rate in this humid, hot-house atmosphere. Inspection of a number of nests shows that they each contain three eggs, very light green in colour, without any markings, in size about 2·5″×1·7″.

The garb of some of the ibis at this colony interests us greatly. Two males, with white-feathered necks, stand by their wives. Can it be that the white ibis does not acquire the adult plumage until after the second or third moult? Or are these birds of the year, born in South India, where nesting takes place very early in the year? Another bird has a bare, red triangular marking on the head, the feature so characteristic of the black ibis. Yet another has the head *completely* red.

The white ibis, though normally an unusually silent species, is guilty of producing at the nesting tree a subdued, asthmatic grunt. The young too, like young egrets and the young of the different species of heron, keep up an incessant, quickly repeated, *chick-chick* chatter throughout the live-long day, and even during the hours of darkness; in the latter case this portends the arrival of a parent with food. When well-feathered the call becomes a piping squeal, uttered at meal times. The young are fed by regurgitation, the parent bringing the black-looking food up to the tip of the mandibles and giving this very tenderly to the callow brood. When they are a little older the chicks help themselves to the 'pigeon's milk' by putting their bills into the adult's beak and obtaining what they want at its base. This seems rather a rough process and the attempts of three young ones to feed simultaneously can obviously prove painful to the old birds, judging by the manner in which the parent ibis sometimes turns its back on the offspring and hurriedly leaves the nest, after a youngster has made an extra violent jab to obtain more food.

The nestling white ibis has a white downy body, black head and neck, pink feet, and the slightly curved bill similarly coloured. The young, when they go out into the world, lack the red membrane under the wing, the feature so characteristic of the adult.

One might imagine that as the white ibis is such a marsh-loving species the black ibis must be similarly inclined. Such, however, is not the case, the two species going their different ways. True, in the winter months the black ibis is often to be seen in canal beds, where the squidgy silt seems to provide it with an abundance of food, but normally it haunts fallow land and the edge of cultivation, subsisting either on insects, or on any grain it can pick up. I have even seen it seize a frog. In their breeding arrangements also the two species differ, the black ibis nesting singly though it is not averse to other species making their homes in the same tree. Nor is the presence of water necessary for this purpose—indeed the nest is usually built well away from marshy ground, though it is, perhaps, most often placed on some *seesum* tree by a canal bank. It is constructed from fine twigs, has a marked depression and is invariably built at a great height—that figured here was eighty-eight feet from the ground. The eggs, usually three in number, are very pale blue in colour and average 2.45″ × 1.7″ in size.

Not only do the white and black ibis differ in their nesting and with regard to their general habits but there are marked differences *inter se.* Whereas the white ibis has the head and neck devoid of feathers, only the head and nape are bare in the case of its black relation. The black ibis' head, moreover, has pitted or tattooed on it, a large, deep red triangular mark. In addition its legs are brick-red in colour and it utters a screaming, clanging note, both when flying and perched. At the roost this species is sometimes very noisy.

The next heronry we visit is occupied mainly by openbill storks, of which there must be at least forty pairs nesting on the old *banyan* tree.

As storks go the openbill is a small bird, standing about two and a half feet in height. At the beginning of the breeding season the plumage is white, with much black in the wings, and the tail black also, the black glossed dark green and purple. About a fortnight or so after the eggs have hatched, the white begins to change to a sullied grey. The legs are long and of a flesh colour. But it is the bird's bill which is most striking and unlike anything we know—when it is closed it is open! This is not really the case, of course, as the tips of the mandibles meet. The bill, however, has the appearance of being open of the prominent gap from about its centre to nearly the tip of the mandibles.

Even now we do not know why the openbill stork's beak is so fashioned.

The openbills are all incubating their eggs and either give us a dirty look as we examine them closely with the glasses, or take no notice of us. From time to time a member of the colony comes in to the nesting tree, dropping its legs and then opening and depressing the tail before finally settling. Owing to a gale that is blowing, one alights too near a neighbouring lesser egret's nest, whose outraged owner *quarks* menacingly and then jabs its dagger-like bill at the trespasser, who is glad to remove his offending presence, to avoid real trouble. Both sexes incubate by day, the one off duty frequently standing by the nest and preening itself very thoroughly for long minutes at a stretch. Then, often, the bird departs suddenly, sometimes merely to fly in wide and ever increasing circles over the heronry, or disappearing out of sight, probably to attend to the 'inner man'.

The nests are considerably larger than those of the white ibis and differ also from those of that species in being lined with lumps of dry grass, or small twigs with leaves still attached. These are added to from time to time as incubation advances; more particularly does this occur during the fortnight after the young first make their appearance. Up to five eggs are laid, creamy-white at first but soon turning to a muddy-brown.

After the eggs have hatched a tree tenanted by a number of nesting openbills is most emphatically one to avoid, especially on a wet day; the branches and foliage are then covered with *guano* and the stench is over-powering.

Painted storks nest later than the majority of species dealt with in this article, the time of their breeding depending on whether the monsoon is a bad or good one; if the former, the pelican-ibis (as the bird was known in Hume's time) begins to build its nest high up in a *pipal* tree about the end of August. When the rains have been good, nesting operations are deferred for a fortnight or three weeks, so that we may expect to find young in the nest even during the first half of December. Sometimes, however, the monsoon fails completely. When this has been the case, I have known spoonbills and painted storks, as well as white ibises and sarus cranes, make no attempt to bring up families. Of course, it may be argued that the birds betook themselves elsewhere, where conditions were more favourable for nesting purposes. I am sure such was not the case as there was no falling off in numbers among the resident birds during the months that they should have been nesting, throughout a long stretch of country extending roughly from Benares to Delhi, with which, for many years, I was thoroughly familiar.

It is nothing unusual to find thirty or more painted storks' nests in the one tree. These are about the same size as those of the openbill. Some are considerably smaller. The nests are made of fine twigs, and almost, invariably lined with long, coarse grass or weeds which the birds pull up from the shallow water or its margin. Both sexes share in building the nest, incubating the eggs and feeding the young. Three, four or even five eggs are laid, dull white in colour and about 2.8″ × 1.9″ in size.

I have photographed the painted stork by the simple if trying method of climbing a nesting tree and chasing the bird about with a reflex camera, but the pictures obtained are not particularly pleasing, lacking that *something* which makes all the difference between a good and a mediocre picture. It is far more satisfactory to study the bird from a *hide* super-imposed on a lofty *machan* built up against a convenient tree, a remark which applies equally to all these tree-nesting marshland species. The construction of a suitable watch-tower will involve considerable labour and expense, but the trouble taken will be amply repaid by the results obtained and the observations made possible from the hiding tent.

Painted storks return quickly to their nests and can be studied at ease. What a pulse-quickening picture the bird presents as it arrives with a crash to feed its young—no grunt, no vocal sound, though often the mandibles are clapped together, particularly if the mate be at the nest, when both birds sometimes bow to each other and then raise their bodies and heads, perhaps repeating the performance two, three or four times before assuming a nonchalant pose. The young, who in the meantime have been attending to their toilet, fighting among themselves, or just doing nothing, now galvanised into action, worry the adult bird, bobbing up and down and spreading their wings. Soon their wants are attended to, the parent stork putting its bill down so that the tips of the mandibles rest on, or almost on, the floor of the nest. After a little effort, when the bill is opened wide, giving the impression that the bird is going to be sick, up—or should I say down?—come a dozen or more *chilwa* or other small fry which are promptly swallowed whole by the young. Should, however, the catch have been something more substantial, a nine- or ten-inch sized fish for instance, greater effort may be required to disgorge the meal. The wings then come into play a good deal, while the bill is opened wider and the neck shaken, before 'vomiting' occurs. A great scramble ensues for the prize, which changes from beak to beak frequently, before disappearing down a storkling's throat, not however, without some difficulty. Then, satisfied, the fortunate youngster rests on its *tarsi* till the ample repast has been well and truly digested. Sometimes it happens that in the competition to secure such a fine mouthful the fish is knocked over the nest. Though lost to the young birds it must not be supposed that the parent stork's angling has been a fruitless venture as Chamar children wait for and collect these 'blessings from above' and eat them, thereby demonstrating that very little is allowed to be wasted in this 'Land we live in'. Mongooses and *pi* dogs too take their quota of the windfalls, the storks making no effort to retrieve any food that drops overboard.

We have two other resident storks, the white-necked and the black-necked. Neither nests in colonies, though the former sometimes shares the same tree with egrets or even an odd grey heron. Its nest, usually built at a considerable height from the ground, is a flattish structure of sticks and twigs, with leaves often used as lining. Three to five eggs are laid, of the usual stork colour.

In northern India, white-necked storks' nests with fresh eggs may be found towards the end of May. The breeding season is prolonged, as I have come across hard-set eggs at the end of July, and young still in the nest, two months later. I cannot say from personal knowledge whether both sexes incubate but they both certainly help in constructing the nest and later feeding the young. Feeding time—when the young are well grown there is often an interval of two or three hours between meals—is anxiously looked forward to by the storklings, and either parent, as soon as it alights at the nest, is set on by the young who endeavour to grasp the adult's beak what time the old bird does its best to 'bring up' from its capacious maw a pish-pash of digested remains

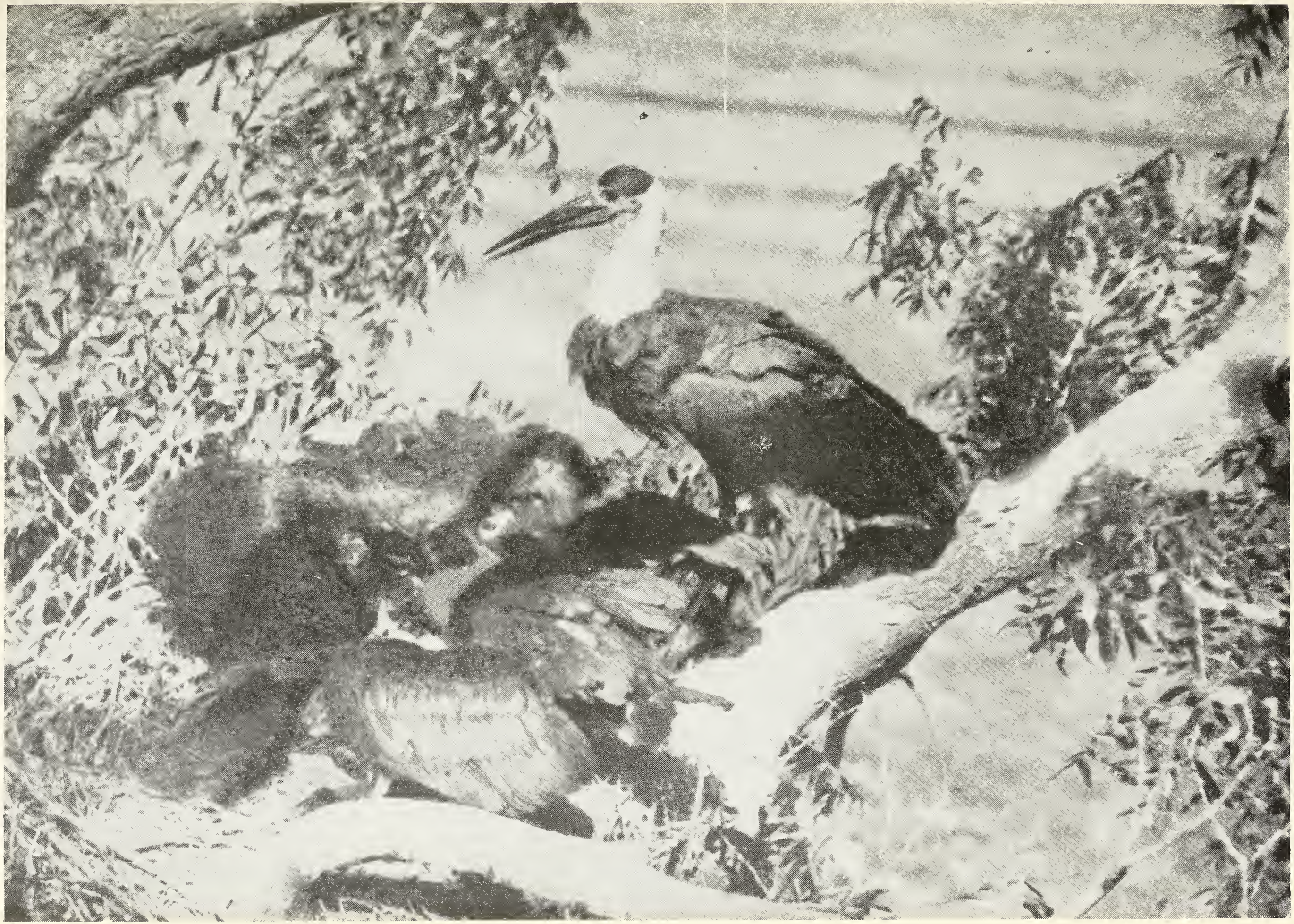
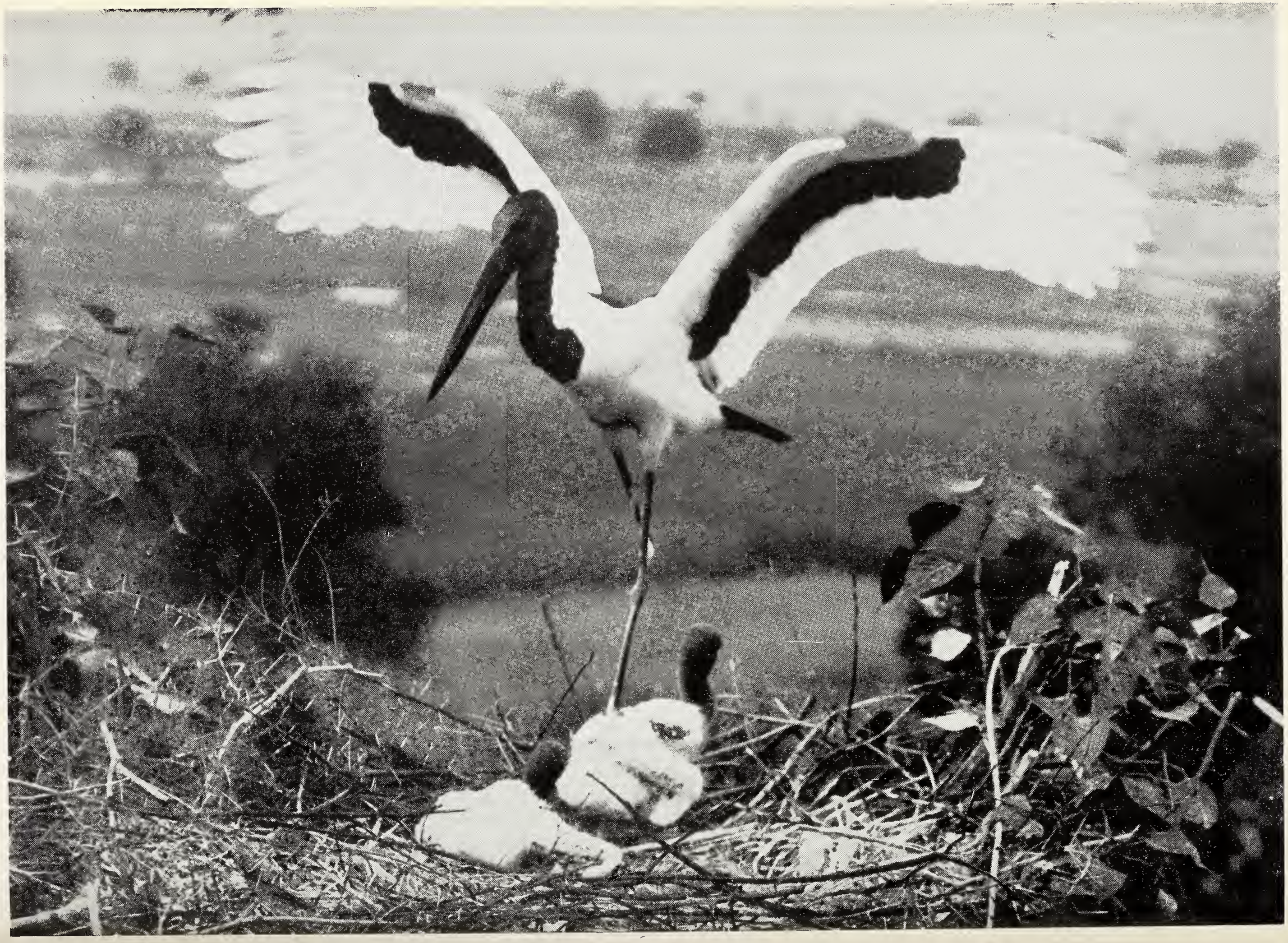


Photo by *E. H. N. Lowther*

White-necked Stork



Black-necked Stork

E. H. N. Lowther

of frogs, fish, possibly a snake, and other such savoury items. When the photograph reproduced here was taken the five young ones were almost ready to leave the nursery. They were not fed individually, the brownish-looking 'porridge' regurgitated by the adult being deposited instead in the bed of the nest. Unappetising, indeed revolting though it looked to me, the young, obviously, considered the meal provided 'good tucker', judging by the manner in which they jostled each other to get at it; in fact the way they 'scrummed' would have done credit to a first class 'rugger' side.

The black-necked stork is a large and remarkably handsome bird, black and white in general appearance, with much green and purple glossing, long coral-coloured legs, and a colossal black beak—about twelve inches in length. It does not nest around village tanks but on the summit of some gigantic *pipal* tree standing by itself in the middle of cultivation, frequently at a considerable distance from water. The nest, a huge affair, three to five feet in width, is made of quite substantial twigs, with finer twigs and dry grass for lining, the twigs and branches invariably of a thorny nature. Three to five creamy-white eggs are laid, in size about 2.90″ by 2.10″.

The photograph of the black-necked stork alighting at its nest having earned some notoriety—it was *hung* at the International Exhibition of Nature Photography held towards the end of 1935 at the South Kensington Natural History Museum, London, and appeared in *Nature in the Wild* (Country Life) which was advertised as containing the World's finest nature photographs—it will not be out of place to explain how it was obtained.

The nest was situated exactly sixty feet from the ground, and was built on the crown of a *pipal* tree growing alongside the Lower Ganges canal a few miles distant from Etawah. An upturned table was secured at the top of the tree, on a level with the nest and only seventeen feet away from it. This served both as a platform for myself and the camera, and provided the necessary supports for the *hide*.

The tent, camouflaged on the outside with branches from the tree, was left *in situ* for a number of days before photography was attempted.

In all I spent twenty-eight hours, spread over a period of five days, studying and photographing this black-necked stork. During the whole of my vigil the male neither visited the nest nor were the young fed at all. (It is a simple matter to distinguish between the male and female; the latter has a lovely golden-coloured eye, while the male's is dark brown, almost black). The female stood on the nest throughout, not once attempting to brood. Certainly she flew away occasionally, as a rule after I had made enough noise to awaken the dead; otherwise she did exactly nothing except watch her two children playing on the nest—tug-of-war with a very dead and dried-up frog.

Not far away, on another *pipal* tree, was a Pallas' fishing eagle's nest. On the rare occasions that the black-necked stork was absent from her nest, the male eagle circled round the stork's tree and twice I had to go all out to prevent it removing one of the young storks. The presence of only two nestlings was probably due to the eagle having previously carried off one or more of the squabs.

My observations lead me to believe that young black-necked storks are fed only between sunset and sunrise. Probably both parents share in this task.

As one watches a party of spoonbills working a strip of shallow, inundated ground, the slightly open bill sweeping right and left alternately, one cannot help regretting that this species no longer breeds in Britain. It did so, in the Fenland, until about three hundred years ago, and to this day nests regularly in Holland. Why then did the bird desert its ancient breeding stronghold in East Anglia? It is difficult to believe that this was due to drainage—the excuse too often put forward to explain the disappearance of a rare species. Far more likely the spoonbill's disappearance as a British breeding species was due to persecution during many generations at the hands of our forefathers, the memory of which has been handed down through the centuries. Clearly the 'good old days' were 'not good enough'; which is a pity as the spoonbill is a grand fowl. It is, however, shy and does not allow of a close approach when feeding. For this reason it is often passed by for one of the commoner marshland birds. If, however, we carry a pair of binoculars regularly we soon discover how generally the spoonbill occurs in suitable country.

In Holland, and elsewhere in Europe, the spoonbill builds its nest on the stumps of last year's reeds, only one or two feet above the water; with us, however, the bird makes its nursery on the tops of tall trees, as it did in England before, I believe, sometimes at the edge of a village tank, on other occasions in more remote parts, but invariably in well-watered areas. It breeds in colonies which may be large or consist of only one or two dozen pairs.

The breeding season is late, from the middle of August till the end of October. The nest is a large stick affair, with a considerable depression, and is usually lined with coarse grass. Three or four eggs are laid. These are white when fresh, with some sepia markings, but often become soiled from the mud adhering to the spoonbills feet after foraging expeditions.

To sit in a *hide,* with half a dozen spoonbills before one, less than fifteen feet away, is a thrilling experience. Both parents incubate the eggs and feed the young who are clothed in thick, white down and have the bill and legs flesh-coloured. The bill, though somewhat swollen, shows no signs of becoming spoon-shaped and is not yet unduly long in proportion to the size of the head. Like other 'blondes' the nestlings are affected by the heat. This probably accounts for one of the parents invariably standing over the young during the first ten or fourteen days of their lives, while the other is absent in search of food. The adult spoonbill's arrival at the nest is heralded by a great rush of wings accompanied by a grunt, a grunt different in tone from the asthmatic effort of the white ibis. The young, who indulge in much squealing and have for sometime been soliciting without success the other parent, now become even more vociferous. Soon their pressing demands for further rations

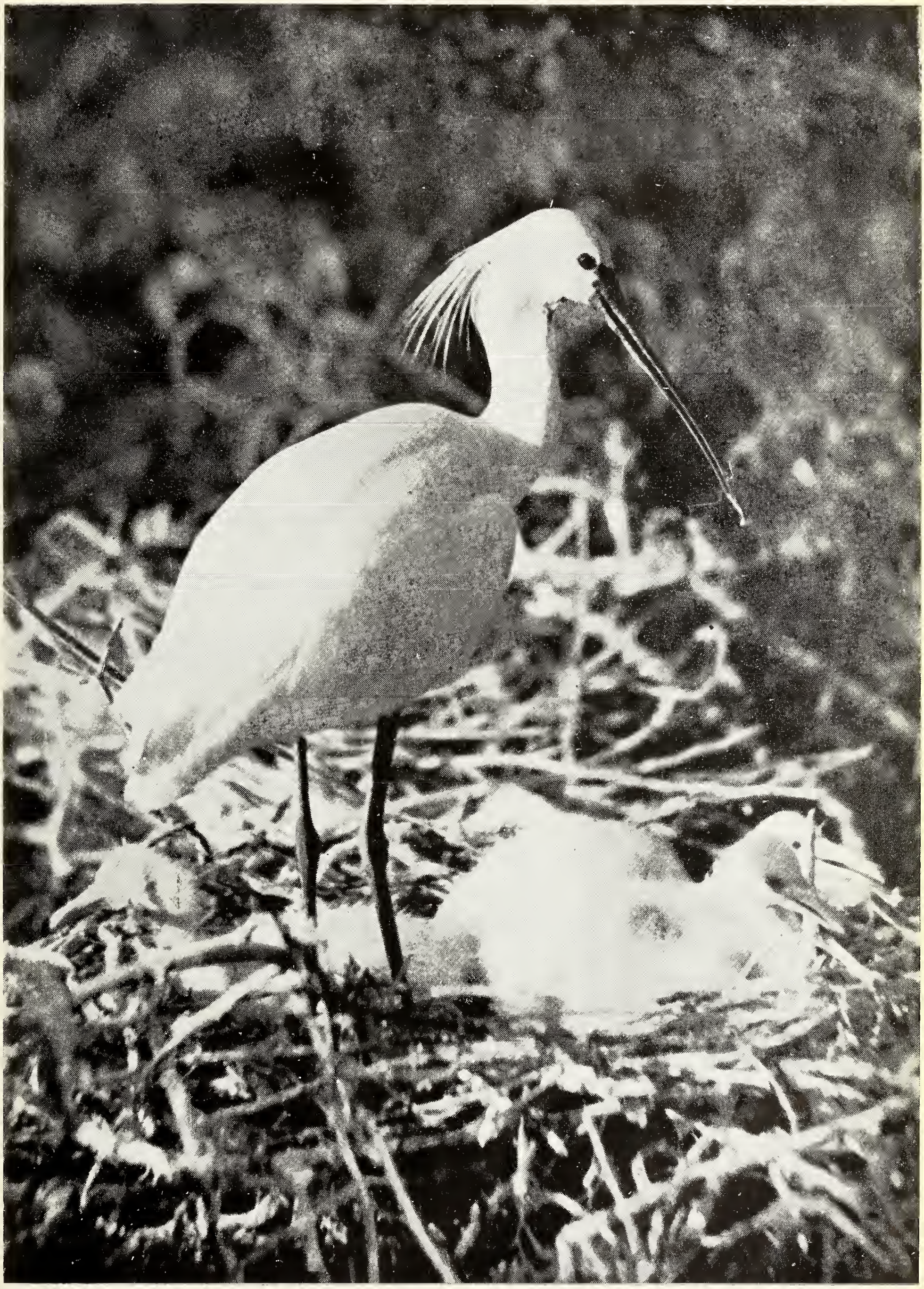


Photo by *E. H. N. Lowther*

Spoonbill.
Platalea leucorodia Temm.

are met. The new arrival lowers its head and allows the young to help themselves, each in turn, to the tasties secreted at the base of the bill.

All the food is not delivered at once, but is given in two or three helpings, with a distinct interval between each. Occasionally it is dropped on to the floor of the nest. What its nature is I have not been able to ascertain, but it seemed to be 'very liquid.' A spoonbill I photographed dribbled all one very hot afternoon till I felt inclined to say, '*get away, old man, get away*'. Another spent a good half an hour spring-cleaning, again and again picking out something from the floor of the nest. This was thrown with a jerk over the shoulder, and as it left the tip of the long bill burst into a cloud of dust. A third, a male, occupied much of his time bringing beaks full of grass to the female. These were gratefully received by her and incorporated in the nest which contained three small young.

I have not photographed the small cormorant from a *hide,* the few pictures I possess of this species having been obtained by the method deprecated when dealing with the painted stork. There is therefore very little I have to say concerning its private life. Two or three dozen pairs may on occasion be found breeding in these small village heronries in company with white ibises, openbill storks and lesser and little egrets. Always they seem entirely engrossed in their own affairs and appear to find life well-worth living, judging by the gusto with which they shake themselves and flap their wings after feeding the young who, along with baby darters, are the timidest creatures I have come across. The diet given seems to consist entirely of small fry, more diminutive even than *chilwa.*

In Kashmir, as in Britain, the grey heron builds in colonies, but nowhere on the plains have I come across more than two nests of this species on a tree though it usually breeds in company with numbers of white ibises, spoonbills and other species, with whom, however, it does not otherwise concern itself. Always the very top of a high tree seems to be selected for the nest site so that photography from a *hide* is not an easy matter.

I was fortunate with a grey heron I once worked on as the camera was rather above the level of the nest; in consequence, instead of looking beyond on to a brazen sky, we are presented with a vista of fields and crops and distant trees. It was a particularly sticky day that I spent in the tent, and although I felt sorry for myself, for at one time I almost collapsed from suffocation, my sympathies were even more with the baby herons who could not have been more than three or four days old and felt the heat greatly during the old birds' absence. The young had been fed about half an hour before I went into hiding at 9, and were not visited again by either adult until 3-30 p.m. When, therefore, the female alighted at the edge of the nest, the young showed their annoyance at this long neglect by darting their bills savagely at the parent who, not to be intimidated, responded several times in like manner. Neither, however, touched the other. After a few minutes of this display of bad temper harmony reigned and the adult 'brought up' a number of tiny fry which were deposited on the floor of the nest. Pieces were torn off these and given very tenderly to each of the three nestlings who, satisfied for the time being, were then shielded from the fierce heat by the mother bird standing between them and the sun, she even spreading out one wing to afford them greater ease. Later, two of the young ate on their own initiative, tearing off small pieces just as the parent had done. The third member of the family, rather smaller than the others, was again fed by the old heron. No attempt was made to give a whole fish, small though they were, to the young.

In the same tree was another grey heron's nest containing five young almost ready to fly. In addition to gasping with the heat they spent much of their time wandering about among the branches in the immediate vicinity of the nest, always, however, returning to their home as soon as they sighted either parent. Invariably the latter announced their return by calling *frank*. Once at the nest, the male and the female were immediately mobbed by their offspring, the young reaching up and 'stroking' the parent's bill—rather roughly at times, it must be admitted. I did not obtain the impression that as a result of this action they expected to have the food put into their hungry mouths; rather I felt they were helping the old bird to part with the meal—a number of small fish usually, and a frog as well on two occasions. One youngster seemed to take no part in 'stroking' the parent heron's bill: instead it kept its head well down in the nest while the *tamasha* was being enacted and was usually the first to make contact with the regurgitated food. Whether this was the reward of intelligence or of being the dullard of the family, its end was tragic. A veritable 'bun scramble' ensued as the food was dropped into the nest, everything being gulped whole. Once a large fish was brought up. The competition to obtain it was keen. In the end, however, it was knocked over the side of the nest. The young were very upset at having lost this treat, and as they gazed dismally down towards the ground below I laughed so incontinently that the old heron opened its wings in a hurry and left in alarm, uttering its familiar call as it departed.

Although common about *jhils* and marshy places the purple heron can quite easily be overlooked on account of the manner in which it 'freezes' when danger threatens or its haunts are invaded. There are records of this species making its home in trees, but the purple heron breeds normally in remote, dense reed beds, a number of reeds being bent over to form a platform as it were, on which the nest proper is built. This is of considerable size and is made of fine, thorny twigs wrenched from *babool* and other similar trees by the birds themselves. There is a fair depression to hold the three to five large light greenish-blue eggs, these often resting on pollen from bulrushes and 'cotton' from *sarpat* grass.

Only one breeding haunt of this species is known to me, and that confined to about twelve pairs of birds. The stagnant water in which the reed bed is situated was alive with leeches, and a miserable time my *shikari* and I had when erecting the sleeper crib from which the bird was eventually photographed, two or three of these scourges seeming to attach themselves to us for every one we succeeded in removing.

The purple heron sits closely, but is of an inquisitive disposition:

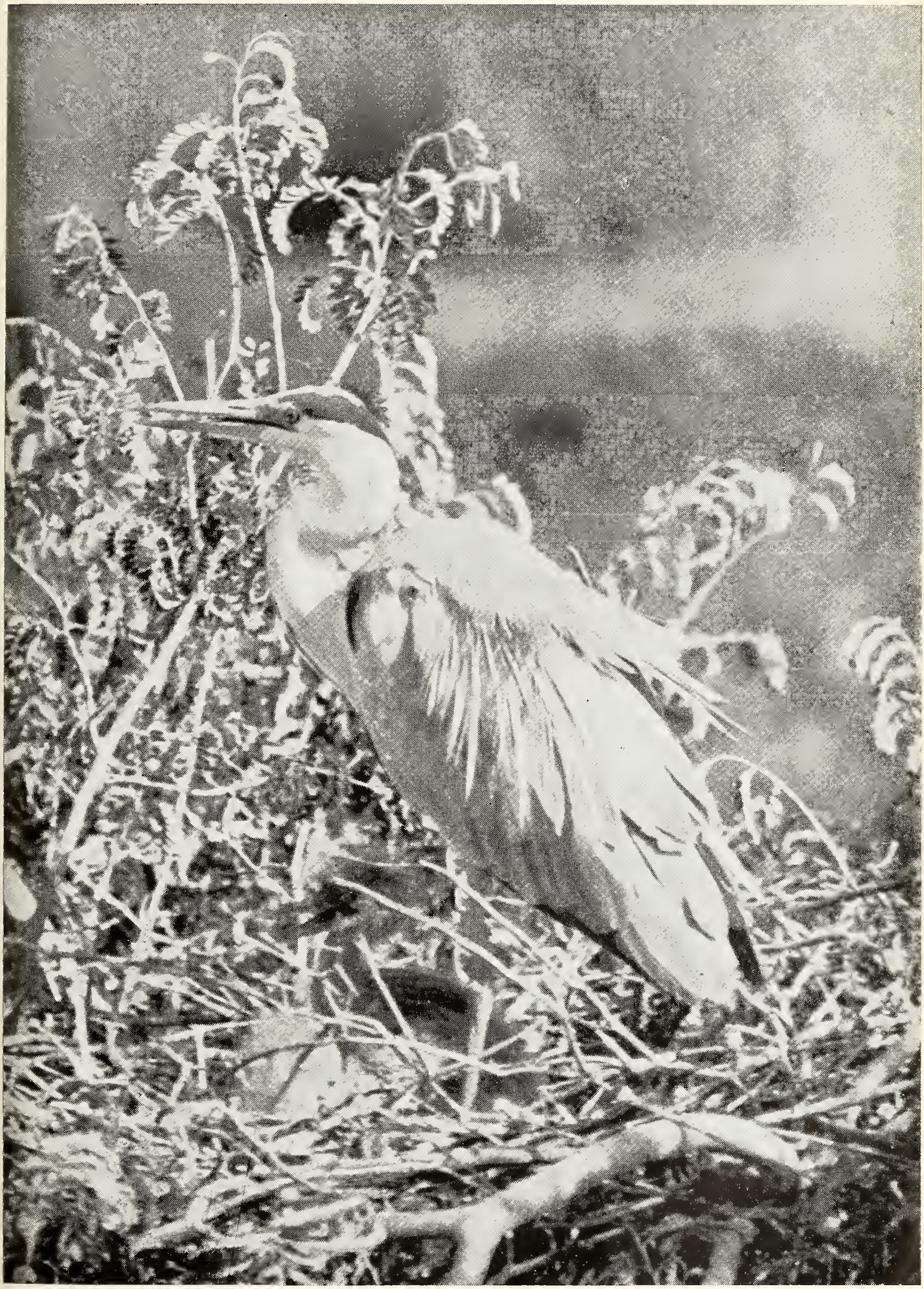


Photo by *E. H. N. Lowther*

Common Grey Heron.
Ardea cinerea Linn.

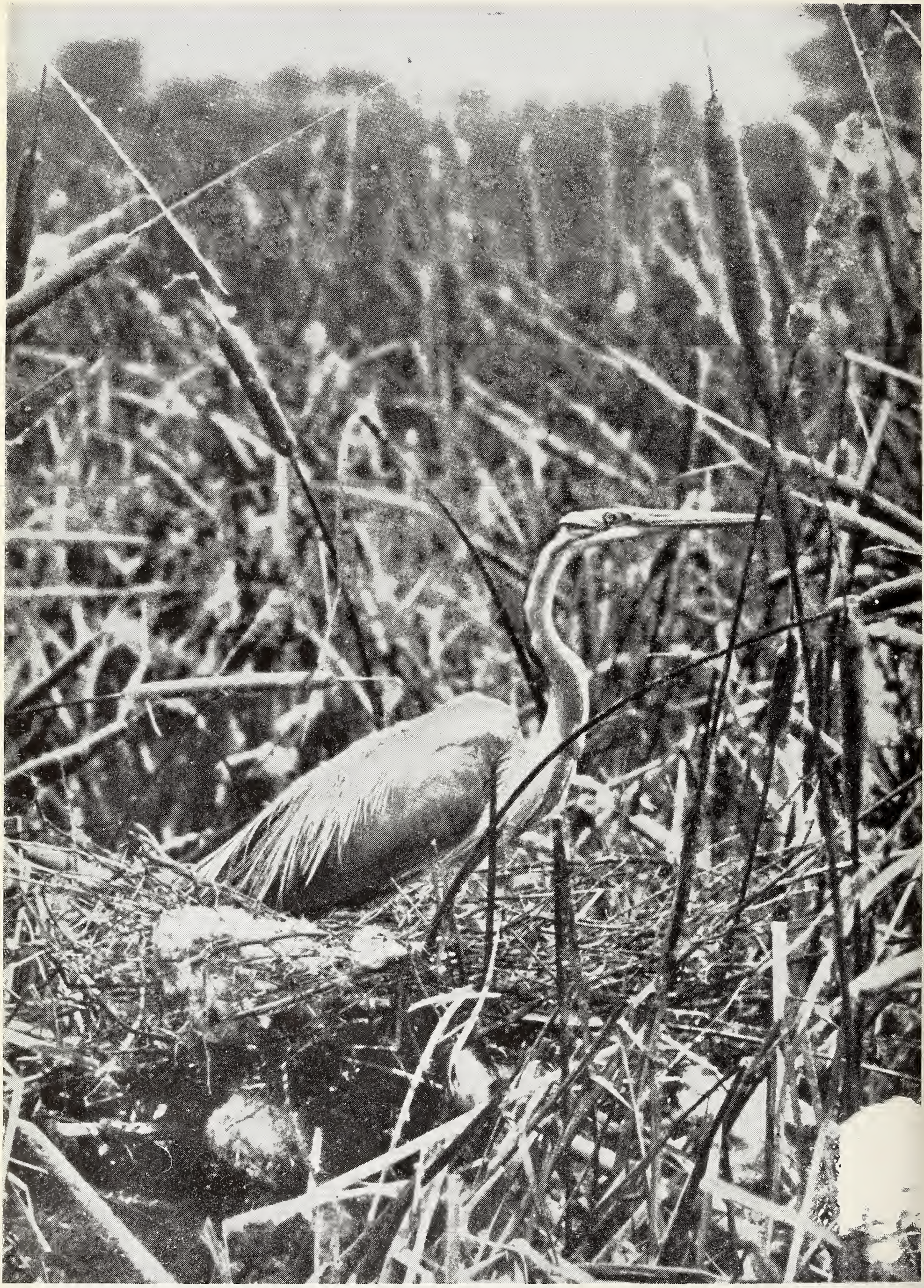


Photo by *E. H. N. Lowther*

Eastern Purple Heron
Ardea purpurea manillensis Blanf. & Oates.

which fact lead to my discovery of its breeding colony. A railway embankment rather overlooks the site in question, and while I was examining it through the field glasses, one long bill and neck, and then others, peered cautiously over the waving reed tops, the better to watch me. Very attenuated they were and by most people the birds would have been mistaken for the bulrushes surrounding them.

Young purple herons, like the young of the different species of bittern, wander about a great deal among the lower parts of the rushes during their parents' absence, probably in order to avoid the direct rays of the scorching sun. Invariably, however, they rush back to the nest on the arrival of the old birds. Great care should be exercised in approaching them as all are capable of inflicting serious wounds with their long, dagger-like bills. My *shikari* received a nasty gash in the hand from a young purple heron as a result of not exercising due caution.

The night heron appears to be distributed very irregularly. Round about Calcutta it is common, and almost every evening at dusk the bird may be seen as it makes its leisured way from its diurnal roosting haunts—usually quiet, well-timbered areas—to the feeding grounds, while its loud and far-reaching call—*quark*—is familiar to all bird lovers. In other parts of Bengal too the species is general, as also it is in many districts in Bihar. In Delhi I used to see it regularly about the public gardens at nightfall; but in those parts of the United Provinces with which I am best acquainted the night heron is decidedly rare, and I cannot remember having found a single nesting colony there.

When stationed at Dhanbad in the Manbhum district, Bihar, the opportunities afforded of watching this species were legion as about eighteen pairs established a breeding colony in my garden. Nest construction commenced with the setting in of the south-west monsoon, both sexes helping to build the nest which was constructed from fine twigs torn from neighbouring trees. The nests, which were somewhat flimsily constructed, were invariably well shaded and never contained more than three light greeny-blue eggs each. Both the male and the female were seen to incubate, and the nestlings were clad in long scraggy hairs of a shade I failed to note and which I cannot now remember.

The young were fed at long, irregular intervals during the day, but it was at sundown, and throughout the night and early morning, that their appetites were chiefly catered for. The noise that they made when hungry or being fed—*chick-chick-chick*, repeated time and again—had to be heard to be believed. Many a sleepless hour we spent on their account, but as we listened to the chattering my wife and I could visualise exactly what was happening in the tree tops.

The stench at a nesting colony is appalling because of the decaying fish and other animal matter that falls from the nests, and it speaks volumes for our love of birds that we allowed the night herons to return year after year to breed with us.

About five miles from our 'house on the hill' was another nesting colony of this species—one of considerable size. Here breeding started earlier and the young invariably left the nest a fortnight or so after the rains commenced.

Young night herons when they leave the nest look a drab-grey and brown—not unlike young terns and gulls at the same age—and give no indication that they will soon don the fine garments their parents wear—white underparts, greenish-black back, grey wings, black nape and crested crown, with white streamers from the latter falling along the back, and that bibulous red eye so characteristic of the bird.

Cattle egrets, little and lesser egrets, also pond herons, *alias* paddy birds, frequently breed together or near one another; and there is nothing concerning the nidification of one which does not apply equally to the rest. All build flimsy twig nests with a slight depression in which are laid three to five spotless greeny-blue eggs. In all four species both sexes help in constructing the nest, but as has already been recorded of the white ibis, more often one bird brings the material while the other's business is to incorporate it in the structure. In every instance both sexes also share in incubating the eggs and feeding the young. During the breeding season all four species don the most wonderful 'ospreys' or aigrettes.

Many people seem to experience difficulty in identifying the different egrets. The following particulars will, it is believed, help to name each correctly:—

Little egret—plumage pure white but beak black at all times. In the breeding season has a drooping crest of two narrow plumes and grows long 'aigrettes' on the back as well as the breast.

Lesser egret—plumage pure white at all seasons; bill black in breeding season but yellow, with a dark tip, at other times. In the breeding season also the facial skin is a vivid green or bluey-green. Then too the bird wears a long train on the back and long plumes on the breast.

Cattle egret—in the non-breeding season the plumage is pure white, but when nesting the bird acquires long golden-buff delicate plumes on the head, neck and back.

Beak yellow at all seasons.

Pond heron—in the non-breeding months is of an earthy-brown colour when at rest, when it harmonises remarkably with the floating vegetation which it usually haunts. In flight appears almost entirely white.

In the breeding season the back becomes a beautiful maroon in colour and from it grow hair-like plumes of the same shade, while a long white drooping crest is also worn.

The bill is black at the tip, yellowish in the centre and blue at the base.

The large egret, not referred to hitherto, cannot be confused with the other species as not only is it appreciably larger, its size approximating to that of the grey heron, but it is a recluse in its habits.

On the 13th of September one year I spent a most entertaining day in my hiding tent photographing lesser egrets at their nests. There were two nests before the camera lens. Each was the home of four young ones and in both cases one squab was noticeably smaller than the rest of the family. The larger young ones spent much time wandering about amongst the branches close to their nests but at once returned to them when either parent arrived. All possessed nasty tempers and jabbed fiercely with their dagger-like bills at other young birds which ventured near, on one occasion even attacking an adult openbill stork. The young appeared to be fed unnecessarily carefully, each in turn, the runt usually last of all. The method employed was different from that adopted by the spoonbill, the lesser egret putting its bill down the young one's the latter in turn seizing the parent's bill with its own. As a result it was not possible to judge the nature of the food. The beak of the young bird when almost ready to leave the nest was seen to be yellow but with a greenish tint at the base; and the feet and skin about the abdomen greenish in colour. More interesting still, I noted that now, at the end of the nesting season, the bill of the adult was black at the tip but otherwise dark yellow, that is to say it had taken on the non-breeding aspect before nidification was ended. Other interesting things I saw this day were numerous thefts of building material from neighbours nests while the latter were absent, and the manner in which those birds that had small, and even large young, renovated and strengthened their nests from time to time.

One word of advice to those who would visit these heronries. Crows are ever present, to rob both eggs and small young ones from nests from which the owners are absent if even for a minute or two. Therefore take a gun with you always, not with the object of discharging it, but in order to frighten away the crows and so give the egrets, etc., a better chance to bring up their families. Crows are far more afraid of a gun than are egrets.

There is one other bird that haunts village ponds that we cannot fail to observe. Already, by its loud diabolical grunts, groans and chortles, it has made itself known to our ears, but being a shy species the white-breasted waterhen only emerges from the bushes at the tank's edge when human peace and quiet reign. Then it makes its nervous way along the water's margin, twitching its tiny tail to show the brick-red underparts. Otherwise the white-breasted waterhen is of a dark slate colour above, with white face, neck and breast, and the abdomen the same colour as the under-tail coverts. The breeding season is from the beginning of July to the end of August, and the nest, which is made of light twigs, lined with rushes, is commonly built in the thick bushes surrounding a village tank, often only two or three feet above the water though more than once I have seen a nest situated quite ten feet from the ground. Four or five eggs are laid, smaller and of a lighter shade than those of the moorhen, but otherwise generally resembling the eggs of that species.

Those who have attempted to photograph the moorhen at its nest in India agree that it is a foe worthy of their steel. To my mind the white-breasted waterhen is an even more difficult subject and the few pictures I possess of the bird are among the most treasured in my collection. The individual I photographed invariably approached the nest in a very stealthy manner and always made its way up to it from the water under the bush, climbing gradually to the nest.

The chick of the white-breasted waterhen is a delightful creature clad in black down and is not only surprisingly active but the young family are wizards at diving and dispersing when hunted.

We have now made contact, as it were, with almost all those species which nest in colonies around many a village tank, and with some others also. Let us then proceed to a *jhil,* or lagoon, which, dry or almost so, during the hot weather, now, at the beginning of August, holds water three or four feet deep. In parts a fine crop of wild rice waves its feathery tops some few inches above the water, while in another direction an aquatic creeper spreads its convolvulus-leafed tentacles over the mere's surface. On the far side of the *jhil* is a small island—really the remains of a narrow *bund* or bank. On this a sarus crane, largest of Indian birds, is incubating her two greenish-white eggs blotched slightly with brown. The nest is a collection of weeds and rushes. For a radius of twenty feet around the island there are no signs of vegetation; it is clear the saruses have pulled it up for their nest—we have actually seen them, or rather the male only, busy on the job elsewhere. He first clears the immediate vicinity of the nest of all the rice or other weeds, breaking them off under the water and throwing them in the same movement over the shoulder in the direction of the nest. At this early stage the female does not have to leave the dry ground, she just picking up what has been cast almost at her feet, to lay the foundations of the nest. Later, as the male's task takes him further away from the *bund*, when the vegetation he has pulled up lies in the water, his mate wades into the element and carries the weeds to the nest, a matter in which he also takes his fair share. But just as the male does not appear to take any part in the actual *making* of the nest so too we have not observed the female assume her partner's role in tearing up the weeds required for the nest. Both sexes certainly incubate—we have watched the 'change over' take place—but our watchings go to show that this task is mostly performed by the female.

In the United Provinces the sarus is a common species and a pair are to be seen in the vicinity of most large stretches of water, and often in cultivation where, it is feared, the birds must do a considerable amount of damage to the ripening crops. During the hot weather too, many foregather by our larger rivers. Wherever found they are a notable asset to the landscape. Their slow, rhythmic flight is the poetry of motion, while the loud trumpet-like call, uttered both on the wing and from the ground, and during the hours of darkness as well as by day, never fails to excite even the most blasé of human beings. And who is there who is not enthralled by the sarus' courtship display, when he and his wife, standing opposite each other, bow to one another and jump excitedly up and down, the while opening wide their enormous wings and closing them again, and uttering the far-reaching note to which we have already referred? This display may be witnessed also when incubation is taking place, sometimes when the male arrives at the nest to see

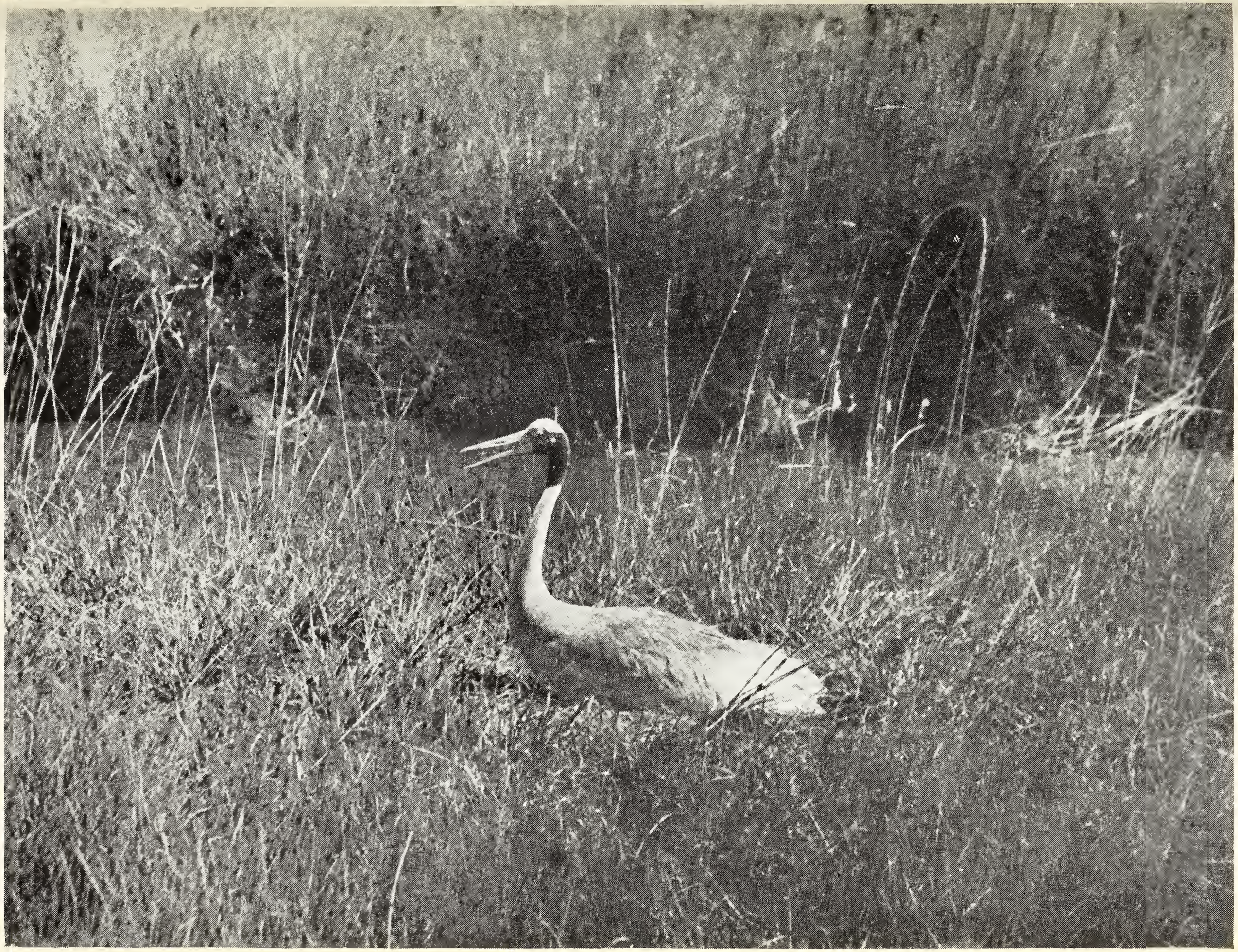


Photo by *E. H. N. Lowther*

Sarus Crane

how matters are progressing, but more particularly when both birds return to the nest after the female has been disturbed from it, 'and find their eggs are still there. Verily are they Darby and Joan, and it is in the fitness of things that the sarus is a life-paired species.

There is another display by the sarus which may be seen during the *chota barsat* and the last days of the hot weather, a performance which seems to express more than anything else the joy of the devoted lover when his betrothed names the wedding day. A sarus calling in the distance may provide the necessary urge, or it may be human intrusion, or the sight of his wife at the far end of a *maidan*. Whatever the cause, the male opens and closes his wings, jumps up and down, calling as he does so, and then runs some distance—not the somewhat awkward mien of the bird shambling away when alarmed, but a smooth, gliding movement as though he were taxi-ing on ice. This beautiful performance may be repeated two or three times in as many minutes, the bird sometimes running about in any direction but ending up where his wife is, when she also may join him in this 'sliding' act.

By virtue of its size alone the sarus demands our first attention, and continues to do so far some time; but even while the binoculars are glued to the bird strange avian calls are wafted to our receptive ears; although, at first, we imagined there was no other bird life on the *jhil*. When, however, we finally tear ourselves away from viewing the sarus—can we ever *really* do so?—we soon spot a black and white bird about the size of a chicken, with a long cock-like tail, apparently walking the water's surface. Then it springs into the air, uttering a musical *mé-ōnp*. The refrain is taken up by others also. They are pheasant-tailed jaçanas. The abnormally long claws and toes which the water-pheasant (as it is often called) possesses cause its weight to be distributed over a large space, thus enabling the bird to walk with ease on the weeds amongst which the nest also is built—usually a sketchy collection of rice stems and weeds. Four eggs, deep bronze in colour and shaped like pegtops, are laid. Their lower surface often rests in the water. The only way to photograph birds nesting in such situations is to dig four stakes deep into the mud and on these erect a platform at water level the next day, covering the whole with weeds. On the third day the tent can be put up, the uprights stuck into holes bored for the purpose in the planks. The work must be done gradually as if the pheasant-tailed jaçana should become alarmed the odds are she will build another nest a few feet further away and remove the eggs to it. This is accomplished by the egg being pressed between the bird's bill and breast and the jaçana walking backwards with them to the new nest.

It is important that the uprights for the *machan* be dug *deep* as otherwise with the weight of the photographer on it the whole may, in the course of a couple of hours, topple over: as happened on one occasion with me when, apart from receiving a very good ducking, I damaged the camera considerably in my efforts to extricate myself from the tent.

From the *hide* one obtains a very good idea of the beauty of the water-pheasant as she proceeds to the nest—it is believed that the female alone incubates. Particularly noticeable are the slaty-blue bill, rather paler at the tip, the pale bluish-grey-coloured legs and feet, and the lovely golden-yellow band down the back of the neck, bordered narrowly with black to separate it from the white of the head and fore-neck.

We, in India, are fortunate in having with us, in the moister parts of the country—Bengal, Bihar and Oudh, for example—another lily-trotter, as the jaçana is called in East Africa : the bronze-winged jaçana. Viewed from a distance the bird appears all black but when seen at close range one realises how handsome it is with its bronze-coloured wings shot with green, chestnut rump and stumpy tail. Otherwise the plumage is black glossed with purple. In addition there is a conspicuous white line from the eye to the nape, and the bill is of a striking tri-colour, red, green and yellow. More retiring than the pheasant-tailed jaçana, with a note I can only liken to a piping squeal, this species is somewhat crepuscular by nature and frequents the more weedy parts of a *jhil,* amongst which it builds a floating nest after the manner of its kind. This is more substantial than that of the pheasant-tailed jaçana. Four eggs are laid, very handsome objects, dark olive-brown with irregular black hieroglyphics and scrawls much like Arabic writing.

On one occasion I had a strange experience while dealing with the bronze-winged jaçana. The bird's nest was about seven feet away from the lens and I had taken four or five photographs when the roller blind cord came away in my hand as I was resetting the shutter—the second time this happened that season. Cursing my luck I decided to 'wait and see', to watch the bird's behaviour and learn (if I could) whether both sexes incubate. The more I gazed on the bronze-coloured wings and the green and purple glossing, the more certain I became that no photographic plate could give even a fair idea of the different shades in the jaçana's plumage : I felt that once again the reward for my labour would only be another set of glary-white pictures giving a totally wrong impression of the bird's colouring. While still pondering the matter and wishing I had waited till the sun was obscured before attempting photography, my thoughts were broken upon by a buffalo wading into the water about twenty yards away, and the resounding whacks of a child upon another animal. This made the jaçana sit up at once. Presently she slipped off the nest but went only a short distance before squatting down in the weeds, amongst which she became almost totally immersed. After a few minutes she returned to her eggs. When the offending buffalo got up to go away, once more the bird left the nest. More buffaloes came and went, to the accompaniment of much childish shouting. Many times did the bronze-wing leave the nest, sometimes in a hurry, on other occasions in not such great haste; as often she returned to it. Each time this happened the bird looked more annoyed than before. When, however, four or five buffaloes arrived and *three children* competed with one another as to which could make the most noise, the confusion created was more than the jaçana could bear: with her beak she pushed one egg after the other into the water and then tore the

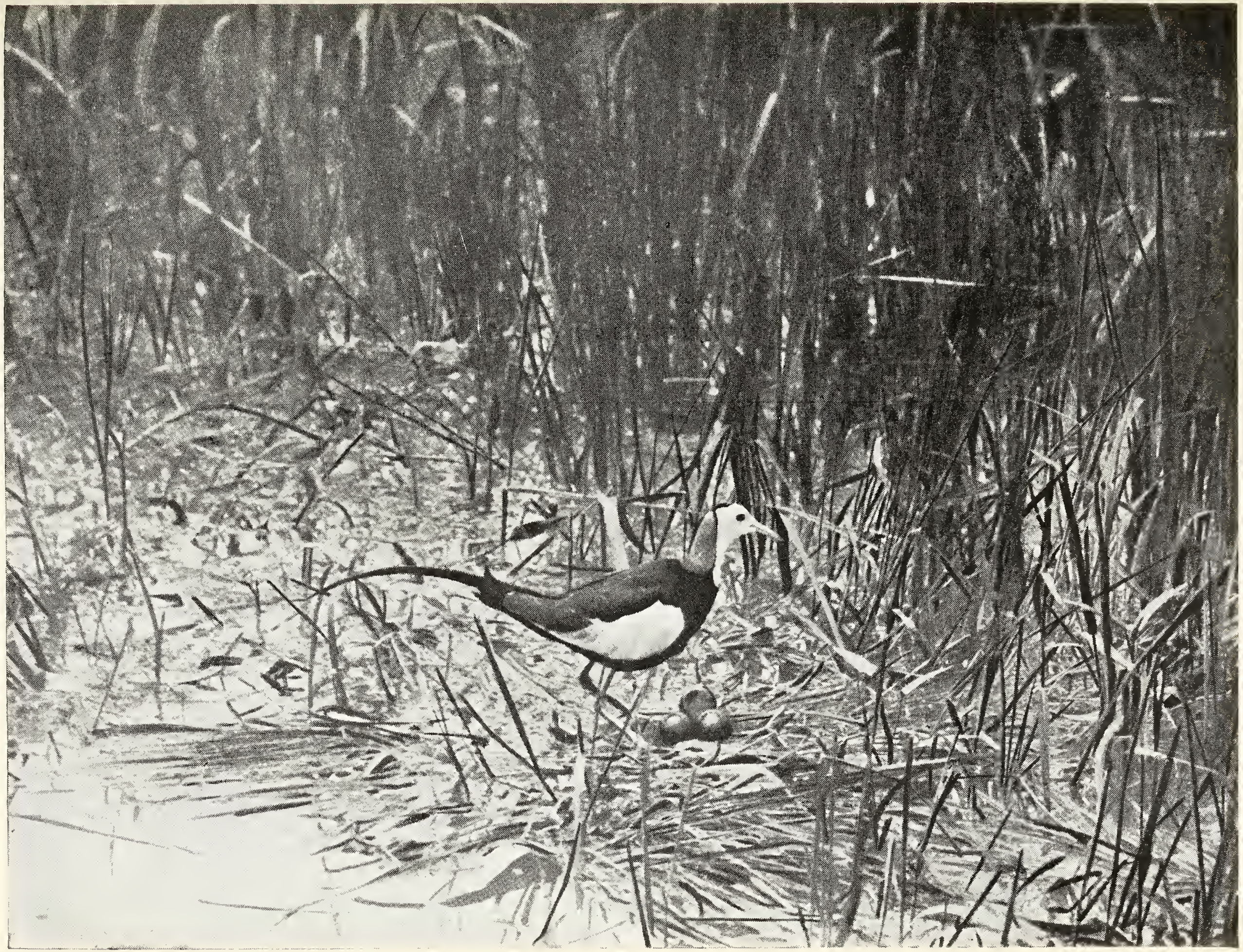


Photo by *E. H. N. Lowther*

Pheasant-tailed Jaçana

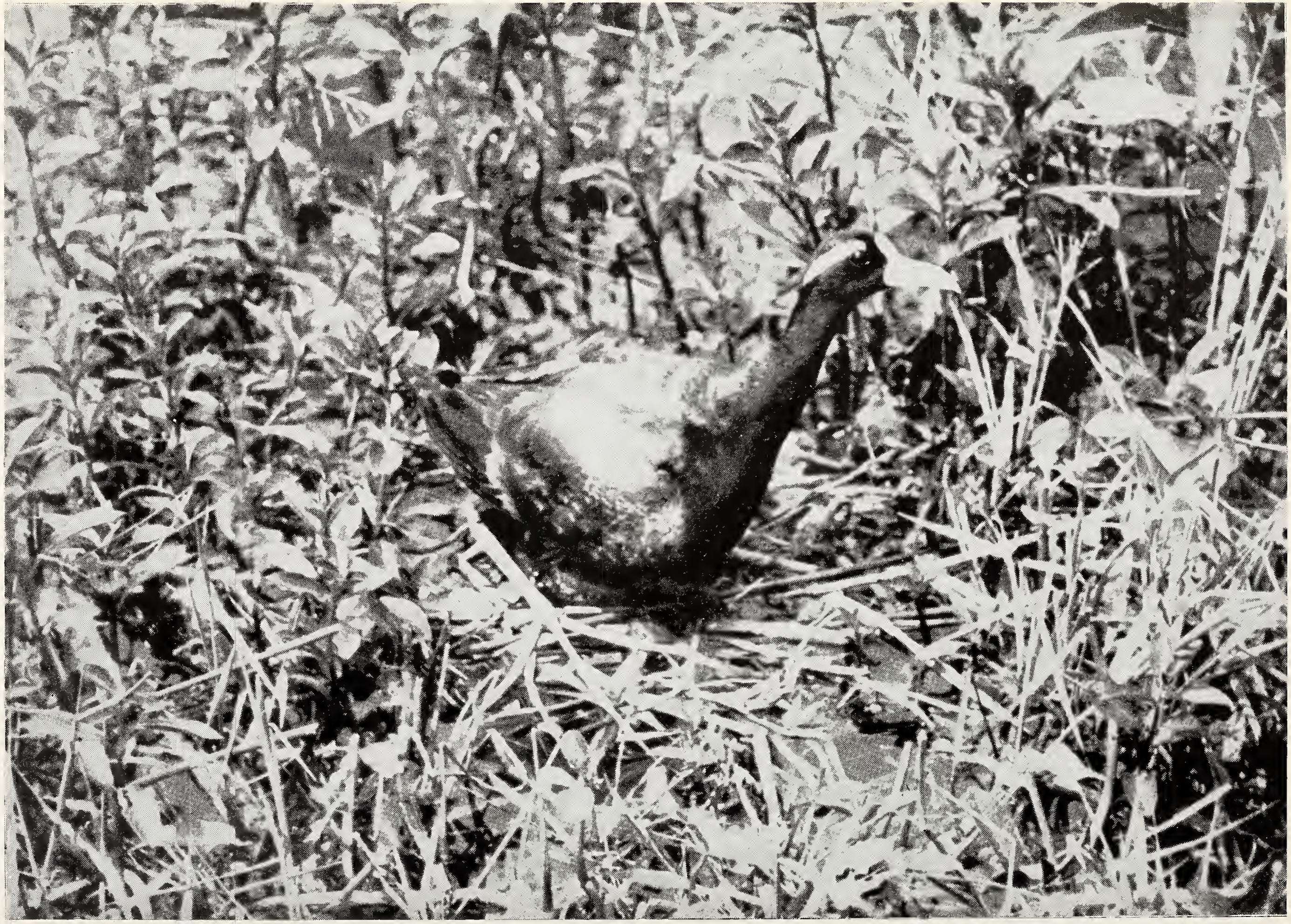


Photo by *E. H. N. Lowther*

Bronze-winged Jaçana

Metopidius indicus Lath.

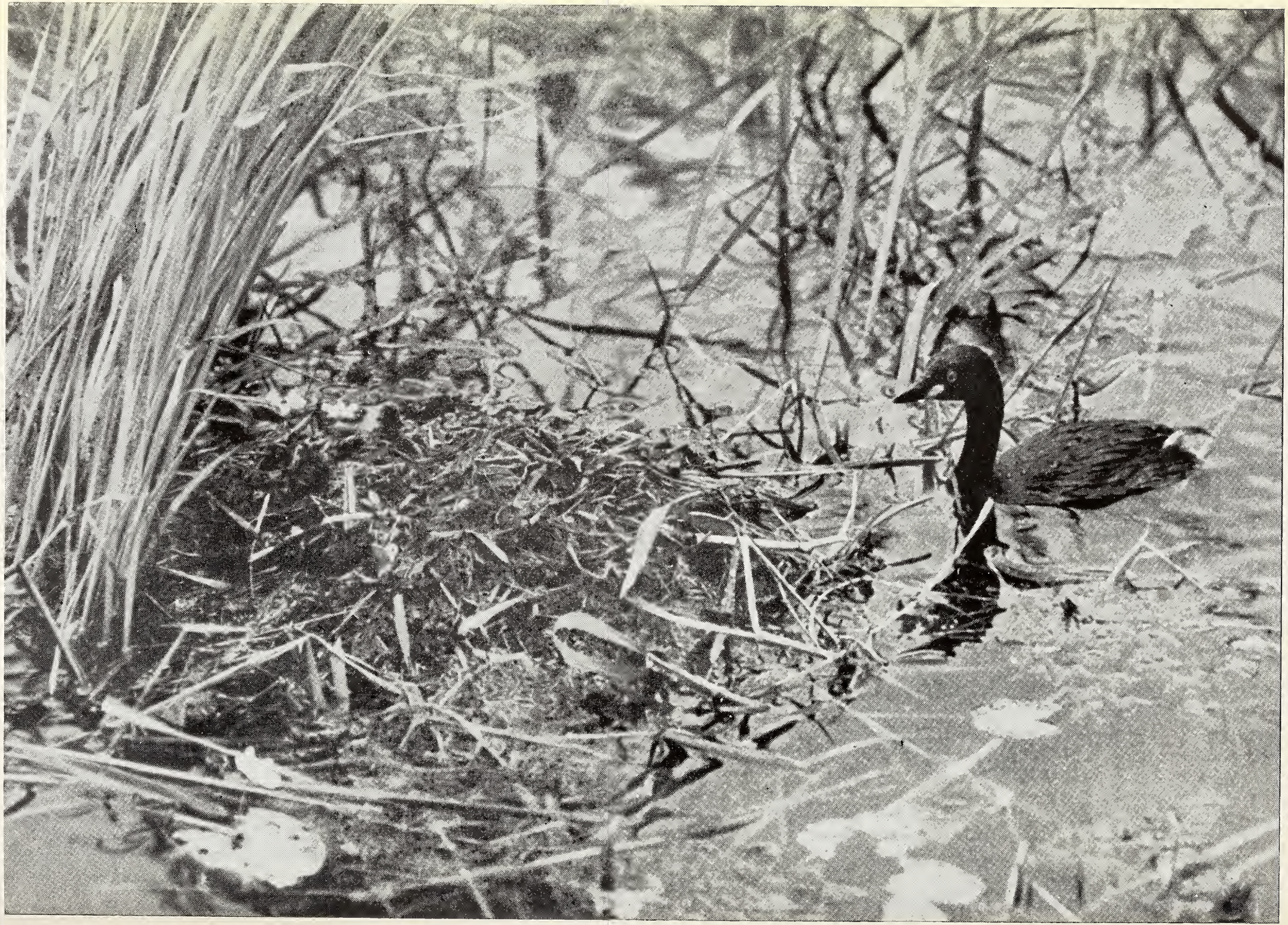


Photo by Little Grebe or Dabchick E. H. N. Lowther nest to pieces and threw the weeds forming it in every possible direction.

A delightfully attractive whinneying note proclaims the presence of the dabchick. The bird is obviously in a straggly reed bed but presently comes out into the open water, swimming and diving alternately. Its nest is a floating pile of dead and decaying aquatic plants, moored usually amongst rice stems, reeds or rushes, wherever the growth is not too heavy. Few would suspect that this collection of dead weeds is a bird's nest. Five to seven eggs are laid, much pointed at both ends and white when first laid but shortly turning to a dark brown colour owing to the soggy state of the nest material. Once, on the Rhotas plateau in Bihar, I came on a nest containing *eight* eggs. Normally this species breeds singly, and usually the eggs are covered over with a pad of weeds kept handy for the purpose whenever the dabchick leaves the nest, but in 1931, near Shadipur in Kashmir, on a piece of water about half a mile square, I counted no less than eighty-three nests containing eggs of the little grebe. During the three days that I spent on this lagoon, I noticed forty-one cases where the birds made no attempt to cover their eggs: it was not that the birds were taken by surprise and had no time to cover them—it was a perfectly open stretch of water and I could be seen all the time from the instant I embarked on the tiny *shikara* from which the census was made. In a number of instances I observed the dabchicks leave their nests. I attributed this departure from the normal to the total absence of crows here. Kites certainly flew overhead but were feeding on small fish which basked on the water's surface and often on the lotus leaves.

The dabchick approaches its nest by a series of dives, the bird having a good look round each time it comes to the surface. Finally, instead of clambering up onto the nest, the bird heaves itself upon it, a matter in which very great energy must be expended. On one occasion a little grebe I was photographing was somewhat reluctant to return to the nest. The arrival, however, of a beautiful male Hodgson's yellow-headed wagtail on the sodden pile very soon brought the dabchick to her eggs, accompanied by the equally hurried flight of the wagtail which had already started uttering its twittering notes, perhaps to express satisfaction at finding such a fine landing-ground on the lake's expansive surface.

In no book that I have read can I remember reference being made to the ivory-coloured marking which appears in the breeding season at the base of the upper and lower mandibles of both the male and female dabchick. This is very clearly brought out in the photograph reproduced here.

Another species which builds a floating nest moored to weeds in open water is the whiskered tern. Very common in summer in the Vale of Kashmir, this tern also breeds in the United Provinces where I found a nesting colony in the Etawah district, and in Bihar where three or four breeding *jhils* are known to me. It is greatly given to stealing building material from neighbours nests, and Colonel B. T. Phillips tells me he has seen the bird upset a whole clutch of eggs into the water when removing a lily stem from another whiskered tern's nest.

In the dense reed beds yellow bitterns and chestnut bitterns pass their secluded lives, only leaving them by day if absolutely compelled to do so. The chestnut bittern is considerably darker than its yellow cousin and is distinguished from it also by the absence of black in the primaries and secondaries, and by the yellow bittern possessing in addition a black crest and having some black on top of the head. Both species are rare in the United Provinces but not uncommon in Bihar; in Bengal they occur more numerously, particularly the chestnut bittern.

The thick reed bed mentioned earlier in which I discovered a small nesting colony of the purple heron was also the home of a pair each of chestnut and yellow bitterns. I failed to locate the former's nest but succeeded in finding that of the yellow bittern. (This was in the Etawah district). A number of reeds had been bent down to form the base of the nest. On this base were pieces of reeds and rushes, woven cunningly, the whole making a pad about seven inches in diameter. Over the nest other reeds were drawn together, to create an awning, the eggs thus being invisible from above. The nest contained five eggs of a very pale skimmed-milk-green colour.

I have photographed both these species at the nest but found them comparatively uninteresting subjects; both sat very tight and obviously trusted to the remarkable manner in which they faded into their surroundings, to avoid detection. When, however, my *shikari* came to let me out of the tent, the birds walked very quietly off their nests on his close approach and made good their escape by keeping to the reeds just above water level. Not on one single occasion did Pokhi hear them moving away.

Many other species of marsh birds there are, some common, others not so general. A few of these I have photographed and have found the nests of others. But it is not my intention to write of these as already this article has assumed alarming proportions and I can almost hear the Editors asking whether I am unaware of the fact that there is a paper shortage. Nevertheless as earlier on I quoted a nesting site of the white ibis referred to in Hume's *Nests and Eggs of Indian Birds* it will not be inappropriate to conclude by recording my experiences when photographing another water-bird, the black-winged stilt, at the Sultanpur salt works about thirty-five miles south of Delhi, almost the only nesting haunt of this species known for very many years and concerning which elaborate details are also given by Hume in his classic. These works have since the time of my visit been closed down and I like to feel I was probably the last ornithologist to study the stilt here. The time of my visit was the 31st of May, 1923. The technique of salt manufacture is not known to me but what I saw were numbers of large, shallow evaporating pans about 150 feet or more square, separated from each other by narrow strips of ground about two feet wide. On these the stilts had their nests, slight depressions lined with tiny pieces of *kanker* and each containing four eggs, very similar in appearance to those of the red-

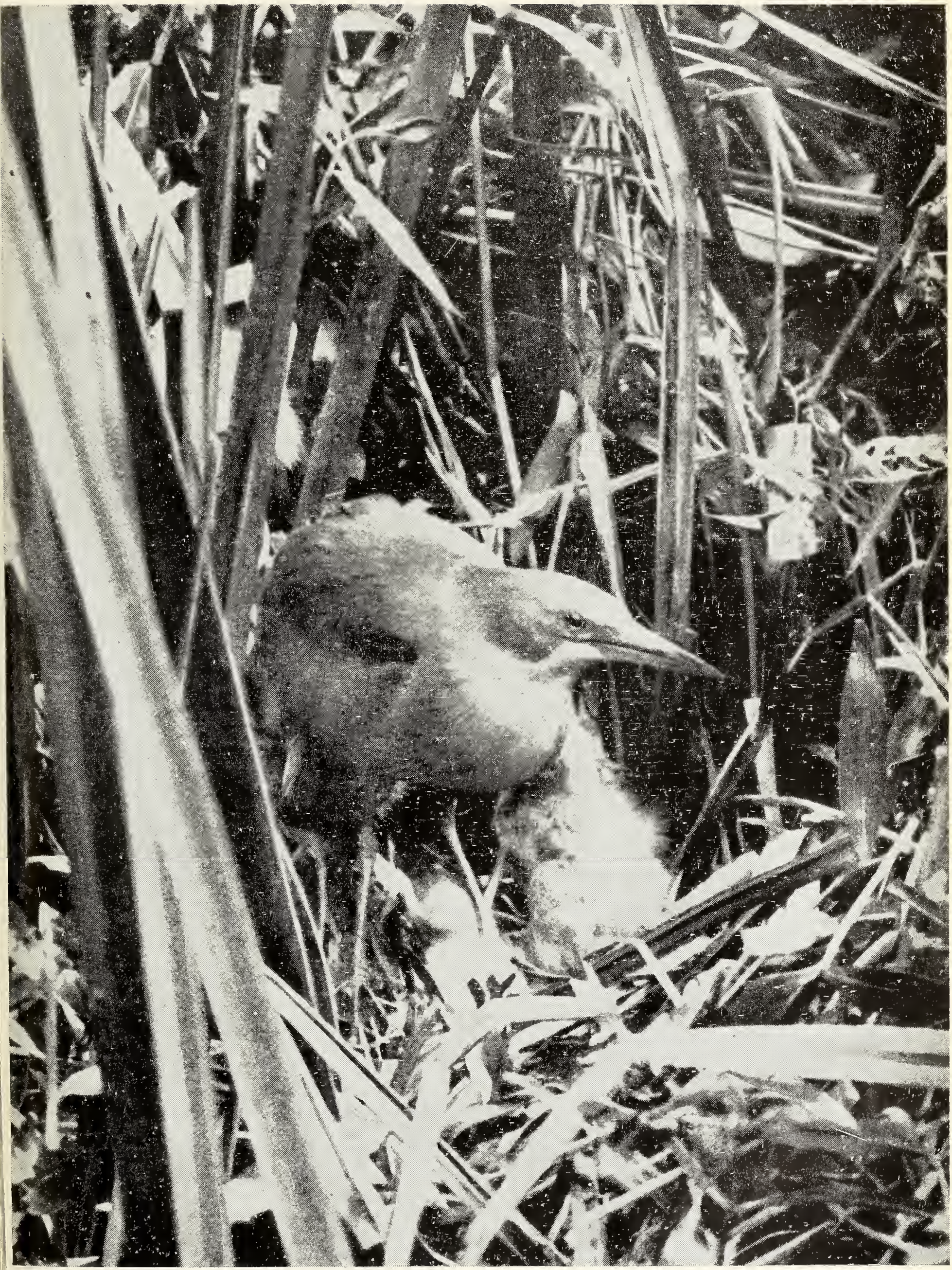
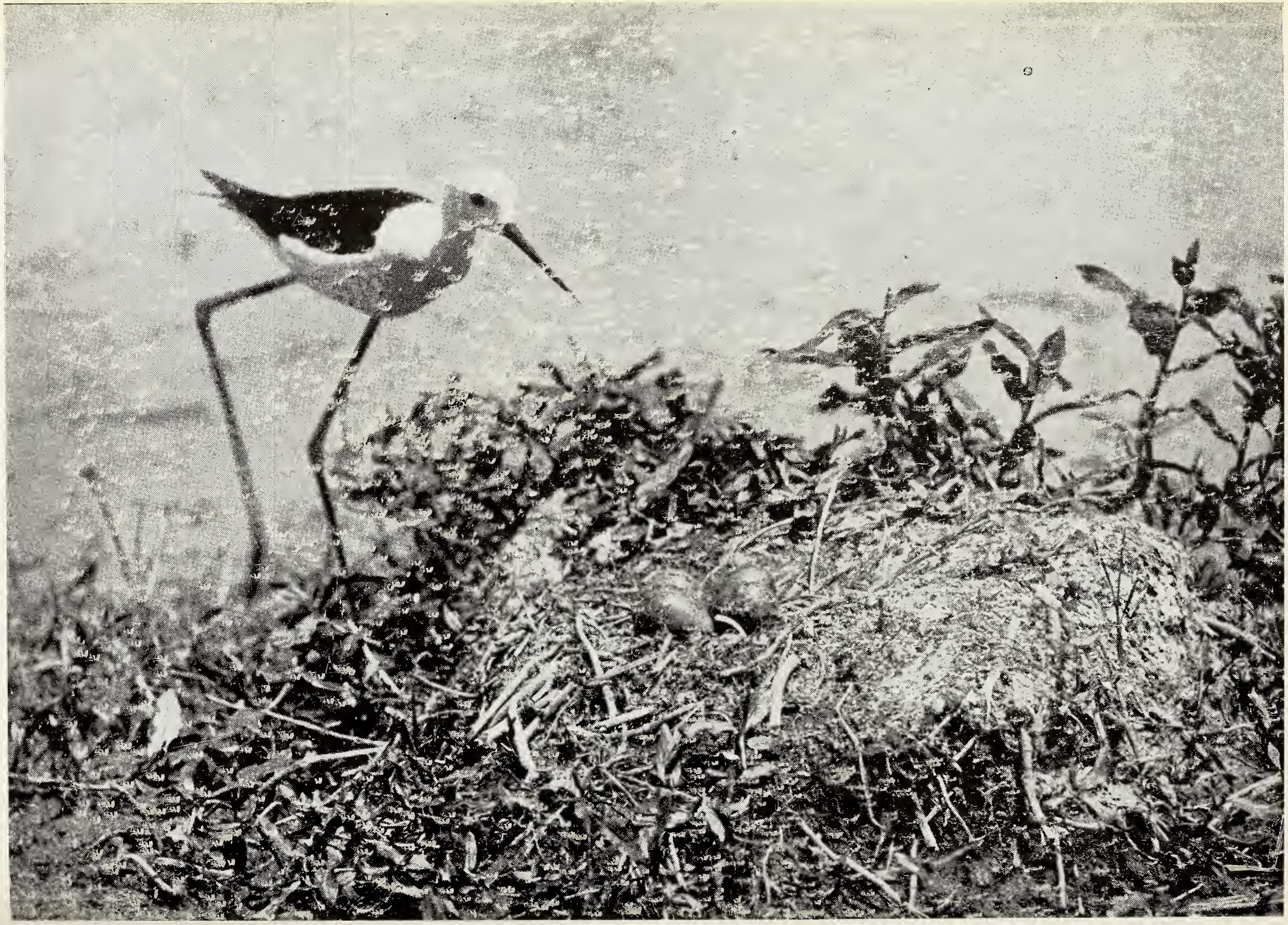


Photo by *E. H. N. Lowther*

Chestnut Bittern

Ixobrychus cinnamomeus Gmelin.



Black-winged Stilt

E. H. N. Lowther

wattled lapwing but rather smaller. Most of the birds, I was told, had already hatched off. Anticipating a long day, I had arranged to catch the 5 p.m. train from Garhi Harsaru back to Delhi, but so confiding was the bird near whose nest I put up the hiding tent that by 12-45 I had used up all the plates with me. Then it was that I decided to make a bid for the train due to leave in fifteen minutes time. Not only had I to dry my feet and put on my boots and stockings, but the camera and tripod, and the *hide,* had to be 'put away'; and we were a mile from the station. My *shikari* and I shared the load and ran the whole way, but when I presented myself at the booking office for our tickets not a word could I articulate; consequently dear old Pokhi had to explain instead. The mineral water vendor on the train, seeing my condition, placed half a dozen bottles of lemonade in my compartment and brought in ice at every station. All these and many more were finished before we reached Delhi, but it was not until after breakfast the next morning that my thirst was quenched! Of course, I know now that I was very, *very* near collapsing from heat exhaustion, as apart from the run I had spent two hours in the tiny tent. Hume says the temperature of the stilt's nest at this time in the full sun probably averages 140° *Fahrenheit,* but then, as Noel Coward observed:—

'Mad dogs and Englishmen
Go out in the mid-day sun'.

A BLACK LEOPARD, AN ORDINARY LEOPARD AND A GOOD BULL TSAING

BY

W. S. THOM.

Leopards were fairly plentiful round my camp and I had to keep a careful eye on my two bull terriers, especially when it got dark, to see that they were not carried off. The villagers residing in a small village of about twelve houses not far from where my camp was situated in the jungle, informed me that quite a number of their dogs, as well as some of their pigs and calves, had been killed by leopards. The pug marks of two leopards that had been seen in the vicinity of the village on being examined by me appeared to be about the same size; so I came to the conclusion that a couple of these animals must be hunting in pairs.

I had left my headquarters to go out into the wild on a month's shoot to see, as I had not shot anything for a long time, if I could account for a good bull Tsaing (*Bibos banteng birmanicus*) the true wild cattle of Burma, as well as bag a leopard or two. I was told that there were several herds and some good bulls among them. Some very fine solitary bulls had also been seen feeding on the neighbouring low-lying bamboo-covered hills and ridges, but that they were all very wary and difficult to get at, especially when lying up in thick cover during the heat of the day. Most sportsmen who have had any experience of Tsaing and Gaur (*Bibos gaurus*), are aware that a solitary bull gaur is much easier to stalk than a solitary bull tsaing. The success or otherwise of a stalk depends a good deal on whether the ground that is to be covered is damp or dry; whether one's trackers, and the sportsman himself are experts at the game; whether they understand the art of travelling through the jungle as noiselessly as possible until near enough to shoot the quarry in a vulnerable spot. What is of the utmost importance however is that the wind must be carefully tested and should be entirely in one's favour till the shot is about to be fired. I need not go into details of this kind as most sportsmen with any experience of big game shooting know how to cover the ground without making any noise when tracking up an animal. Needless to say the sportsman's sight and hearing should also be very good. When out after big game, my senses were always at the utmost tension especially when about to fire at an animal that I had been stalking, whilst I could invariably tread as noiselessly as a cat when moving through the jungle. Years of practice and experience of big game shooting brought my sense of smell, touch, hearing, sight and my tread to a very acute and highly developed condition.

My weapons on this shoot consisted of a single 500-bore high velocity rifle by Westley Richards taking a charge of 80 grains of cordite, a 423 Mannlicher Schoenauer magazine rifle, and a double 12-bore, hammerless ejector shot-gun with S.S.G. buckshot cartridges.

I have used many different kinds of weapons when shooting large and small game in Burma from the year 1887 to the end of the year 1940 and their use always gave me very great pleasure. Let me describe some of them in this article. Three of these weapons seldom, if ever, failed me when in a tight corner. They were a double hammerless 8-bore Paradox, a double hammerless 8-bore rifle and a single trigger 577 ejector rifle by Westley Richards which took a charge of 100 grains of cordite. The two 8 bores each took a charge of 10 drachms of black powder. Later on I came into possession of a single take down 577 cordite rifle by Westley Richards which took a charge of 100 grains of cordite. This was a very serviceable and perfect weapon. I could sprint a hundred yards carrying it easily in one hand as I ran to overtake any animal that I had wounded. Then I owned a double hammerless 303 Lee Enfield rifle, sighted up to 300 yards. This was a most accurate weapon for all thin-skinned animals such as sambar, serow, goral, barking deer, pig, wild dog. On several occasions I also accounted for several leopard and bear with this weapon, using soft nose as well as service bullets. What a wonderful weapon the 8-bore Paradox was to be sure. I seldom failed to bring down any animal with my first shot. The conical bullets used in the cartridges of this weapon were heavy and they invariably set up beautifully. Only on one occasion, did I fail to bring down at once a bull that I had fired at. I was walking alone ahead of my men along a ridge, on the water-shed on the top of the Yoma mountains, which overlooks Arakan and Thayetmyo District at a height of about 4,000 feet. Away down in the valley I could see the steamers coming up and down the Irrawaddy river on my right and on my left the sun setting with a glitter over the sea on the Arakan coast miles away. Then I came suddenly on a solitary bull gaur, a very large animal, which was walking in my direction along the ridge. When it saw me it stopped dead and threw up its head. The animal was then about 30 paces from me. I fired at what I took to be its chest with the Paradox, but the animal turned round as if on a pivot and galloped off at a great pace for a distance of about 400 yards as if it had not been hit. Then suddenly after hitting the burnt stump of a large tree it collapsed with a crash, stone dead. I found afterwards that my bullet had hit the animal's nose and after travelling down its gullet had lodged in its stomach after badly raking its lungs and internal organs. The bullet was afterwards picked out and handed to me by one of my men when the animal was being cut up. The double 303 Lee Enfield was, as I have stated before, a perfect weapon for most animals except elephant, tiger, gaur, and tsaing. As a matter of fact, it really was not quite good enough for leopard, sambar or bear. I got two bull gaur and a tigress also with it. Those were however special occasions and picked shots. In the case of the two gaur I used cartridges loaded with service bullets. The tigress was shot with a single cartridge and a soft nose bullet, the latter passing through both its lungs. It is not however, what a weapon will do on certain occasions, but what it should do on every occasion, and a good big 'un' is always better than a good little 'un'. I also possessed a beautiful 236 W.S.N. magazine rifle which accounted for a good many thin-skinned animals such as serow, goral, pig, barking deer and wild dogs. I had at different times two double 12-bore hammerless ball and shot guns both of which took a charge of about 4¾ drachms of smokeless powder. These weapons are all right when used in beats, when the jungle is being driven for such animals as bear, pig, sambar, leopard and barking deer, but they are not powerful enough for tiger, although I bagged the record tiger of Burma at Sinbo in the Myitkyina District using one of them. It was what is known as a 'Cosmos' ball and shot gun by Cogswell and Harrison but, as I have said before, it should never be used on a tiger, and certainly not on elephant, gaur or tsaing as the powder charge is quite insufficient. It is quite a different matter when a 12-bore magnum 'Explora' gun is used on some of the large animals as it is a very powerful weapon with a powder charge good enough to kill most animals.

One night at about 9-30 p.m., when about to turn into bed, a Burman hunter from a neighbouring village arrived at my camp to inform me that a leopard had attacked one of his dogs the same night at about 7-30 p.m. The dog had escaped with a nasty scratch along its back which it received as it leaped into the house. Although several persons had heard the dog yelp loudly once, no one had seen it or the leopard. I informed the *shikari* that I would see what could be done on the following day. Next day I decided to have a machan erected at a spot near a thicket about 250 yards from the village—a site which I had chosen before. I hung up a leg of a doe sambar, killed several days before by wild dogs, which my men had brought in. It was hung from a stout branch with a strong piece of rope, about ten to twelve feet from the ground. At about 5-30 p.m., armed with my 12-bore shot gun and S.S.G. cartridges and the 423 magazine rifle I entered the machan alone. It was not more than about eight feet above the ground. At about 7 p.m., when the light was just beginning to fade, a magnificent black leopard stepped out of the thicket and began walking slowly towards the bait, flicking its tail from side to side. When it got exactly beneath the bait, it stopped. The animal then began to sniff the surrounding air uttering a succession of peculiar purring sounds, after which it lay down on all fours in a crouching position as if about to spring on the meat hanging above its head. I did not wait to see any more and let the animal have one shot from the 423 with a soft nose bullet, which got it luckily through the vertebrae of the neck. The animal, on receiving the shot turned a complete somersault and remained perfectly still except for a few spasmodic movements of its tail. It certainly was a lucky shot to have hit it where I did, and I was just going to get down from the machan to inspect the dead animal when, to my utter surprise, two ordinary leopards sprang out of the same thicket. After trotting up to the dead animal together they sniffed at it once or twice and then looked up at the sambar's leg that hung so temptingly above their heads. After reading this some people might be inclined to think that I am drawing the long-bow and making up this yarn. Well believe it or not as you like. I finished off one of the two leopards with one shot from the choke or left barrel of my 12-bore shot gun. The choke took a number of the S.S.G. buck shot together which entered the brain of the animal through its left ear. The black leopard turned out to be a very fine male measuring 7′ 6½″ in length. The second ordinary leopard bagged by me taped 7′ 3″ in length and, as it was the cold weather at the time, both animals had very fine coats. When the villagers and my hunters arrived on the scene and saw the black leopard they were very astonished but all of them agreed that this must have been the animal that had killed and carried off their calves.

Tsaing, the true wild cattle of Burma, are very fine game looking animals for their size, a good bull often standing as high as seventeen hands at the shoulder. I have shot quite a number of old bulls during the past 50 years of my stay in Burma, some of them with very fine heads. I have found from the many experiences I have had with these fine animals that, when wounded or at bay at close quarters, they are never really as pugnacious or as dangerous to tackle as some of the solitary bull gaur (*Bibos gaurus*) that I have shot. In fact I have had more narrow escapes from death through being charged and struck by the horns of wounded gaur than from any bull tsaing. I do not believe either that a bull tsaing, although generally speaking a more active animal, can travel any faster when charging than a bull gaur. I am inclined to think in fact from the many experiences I have had, that a bull gaur when it means business, and is really charging after being wounded, usually travels much faster than a bull tsaing. To say also that a bull gaur seldom charges at all is utter nonsense, I have been charged by them on four separate occasions, two of which nearly finished me off. I have no recollection of ever having been charged in a business-like manner by a bull tsaing. Although I have been in several nasty situations with several wounded animals. I have always considered a wounded bull gaur to be very dangerous indeed when it is being followed up. There is not the slightest doubt about this in my opinion. Experience has shown me that a wounded gaur is more likely to charge a sportsman that is following him up than an unwounded animal, although I remember very well being charged on two occasions by two solitary bulls that had got my wind and had not even been seen or fired at by me. Some solitary bull gaur are of course more cantankerous and savage than others. It often depends on whether the animal is a cunning old stager, or a bull that has been made cantankerous and fierce through having been fired at and wounded frequently by Burman hunters using inferior weapons, or whether it has been attacked by tigers on different occasions and is therefore always on the look out for danger and ready to charge on hearing anything approaching it. I once shot a very savage old solitary bull gaur that was minus its tail, and blind of its right eye. I was tracking him on foot as he was about to cross the railway line into the Pidaung plain in the Myitkyina District of Burma. Some gangway linesmen, or railway coolies, coming along the line disturbed him, so he turned back along his tracks and was passing me at about 15 paces, I being on his right or blind side. I was using a single take down 577 rifle by Westley Richards burning 100 grains of cordite. He tried to get at me though floored him with my first shot—a soft nose bullet which passed clean through his body, but as I happened to be on his blind side, where he was unable to see me, I dropped him again with a second shot clean through his body, but as he struggled hard to regain his feet to get at me I killed him with a third shot which got him in the neck. It took a lot of doing of course, and I thought at one time that it might be able to get at me. I certainly was a bit shaken when it was all over. I had opened out a fresh tin of twenty 577 cartridges that morning so they were fresh and in splendid condition. A twenty hand bull gaur sometimes takes a lot of lead before he can be properly accounted for, unless he is hit in the right place with the sportsman's first shot. I consider that next to a wounded tiger, and then a wounded leopard, no more dangerous animal can be followed on foot than a wounded bull gaur.

It is very difficult to choose the best bull tsaing when one comes upon a herd as there may be two or three good bulls equally worth shooting. It is necessary for the sportsman to bring a powerful pair of binoculars with him to discover at once which animal carries the best head. It does not necessarily follow that the biggest animal in a herd possesses the finest pair of horns. I have shot some very big gaur running up to 20 hands, and also some very large tsaing, and found that they had indifferent heads, whilst other animals, gaur of 18 and 19 hands, had very much finer heads. The same remarks apply to the size of the tracks of an animal that a sportsman may be following up. I have tracked several solitary bull gaur as well as tsaing that had enormous tracks and then found that their heads were most disappointing. This is the case however more often with gaur than with tsaing. I may be wrong of course, but the conclusions arrived at by me is that what an animal gained in the size of its body it seemed to lose in the size of its horns.

My men turned up one morning and informed me that they had come upon the tracks of a herd of about thirty tsaing and asked me whether I would follow them. I agreed to do this taking only my single 500-bore cordite rifle, which took a charge of 80 grains of cordite. After following up the tracks till about 6 p.m. we came upon the herd scattered over a ridge covered with dwarf bamboo jungle. Some of the animals were feeding on bamboo leaves, others were cropping the grass. I picked out with my binoculars two good bulls. They were standing alone together apparently doing nothing for they certainly were not cropping the grass or browsing off the bushes, or feeding on bamboo leaves. I could see them shake their heads occasionally and whisk their tails from side to side though there did not appear to be many flies about, it being then the cold weather, but a good many flies always follow herds of gaur as well as tsaing throughout the year. In the hot weather and beginning of the rains gad flies worry these animals dreadfully. I once came upon a solitary bull tsaing trotting along through the jungle. He passed without taking any notice of me, at a distance of only about ten yards, surrounded by a dense cloud of gad flies that were punishing him dreadfully, for he shook his head from side to side as he covered the ground. I killed him with one shot using an 8-bore rifle. The bullet passed through both his lungs.

Fortunately for my hunters and myself the wind was in our favour as we approached the two bulls standing alone. I only had two trackers with me. The fewer followers you have when following an animal the better, especially when approaching such wary animals as tsaing. Well to cut a long story short, I managed to get within about forty yards of the two bulls and then let the one that appeared to have the better horns a raking shot forward through the small of the ribs with a soft nose bullet from the 500 bore. The animal stumbled and lurched forward slightly on receiving the shot as if it were coming down, but recovered at once and made off followed by the other bull. The rest of the herd dashed away in different directions on hearing the report of my rifle. It took my trackers and I another hour and a half steady tracking before we came up with the wounded animal, which beyond shaking its head and snorting at us, could not do anything as it had been rendered more or less *hors de combat.* I then finished the bull off with a second shot which perforated both lungs and brought him to the ground after he made a gallant effort to keep himself from collapsing. The bull's horns were well corrugated and taped 70 inches from point to point across the forehead. I saw the companion of the dead bull standing under a bamboo clump not more than 150 yards from where my trackers and I were standing, alongside the animal I had shot. I had no desire however to shoot another animal as I considered one good bull accounted for in a day's shoot was quite enough, in spite of my trackers' earnest request that I should shoot this animal also. All that Burman villagers, hunters, and trackers usually think of when they accompany a European sportsman on a shoot is how much meat they can become possessed of at the end of a shoot. Nothing would please them more than shooting half a dozen tsaing in a day and allowing to carry off all the meat.

39 Lytton Road,
Dehra Dun.

WHERE THE RAINBOW ENDS.*

BY

LT. COLONEL R. B. PHAYRE, M.C. (Rtd.)

'Great big fish of a variety unknown to us, with red cheeks like those of an English master.'

This was the somewhat astonishing report sent by an old Sinhalese village fisherman to the Secretary of the Ceylon Fishing Club, after some strange fish had been breaking up the villagers' lines, tackle and nets at a spot many miles below the Club waters. These fish were subsequently identified as 'Rainbow trout,' with which the upper waters had been stocked. To reach the lower waters, they had to negotiate a series of most formidable falls, including leaps of 100 feet, while in some places, the river dropped 1,530 feet in 800 yards.

What is the exact definition of a rainbow trout? These elusive fish, which have a mysterious habit of disappearing completely, have always been the subject of great interest and controversy among keen anglers. Even the experts disagree. Although screeds have been written on the salmon, brown trout and sea trout, there is surprisingly little literature on the subject of the rainbow, and it is worth while examining some of the evidence on the subject.

Origin.—The rainbow originated in the River McCloud, a tributary of the Sacramento in California. The indigenous fish was known as *Salmo shasta.* This trout was purely a non-migratory river fish and it is important to note that it has about 160 scales along the lateral line, and 63 vertebrae.

In the same river there was another very similar fish, known as the steelhead (*Salmo rivularis*) or *gairdnerii*, but described by some writers as *S. irideus* and also *iridens.* It is definitely an anadromous fish, *i.e.* it is migratory, like the salmon and makes its way down to the sea. The count of scales along the lateral line comes to approximately 130, with 60 vertebrae. Dr. Kendall, the scientific assistant to the United States Department of Fisheries, described *shasta* and *rivularis* as 'two entirely separate fishes', but others disagreed.

Up to two pounds in weight, it took an expert to differentiate between these two species.

Accepting the statement that these two species are distinct and interbreeding took place, the hybrids also produced progeny but on a reduced scale and inferior to their parents. These hybrids were termed by some writers *S. irideus.* In habits and appearance they more closely resembled the steelhead (migratory) than *S. shasta* (the purely river and non-migratory fish).

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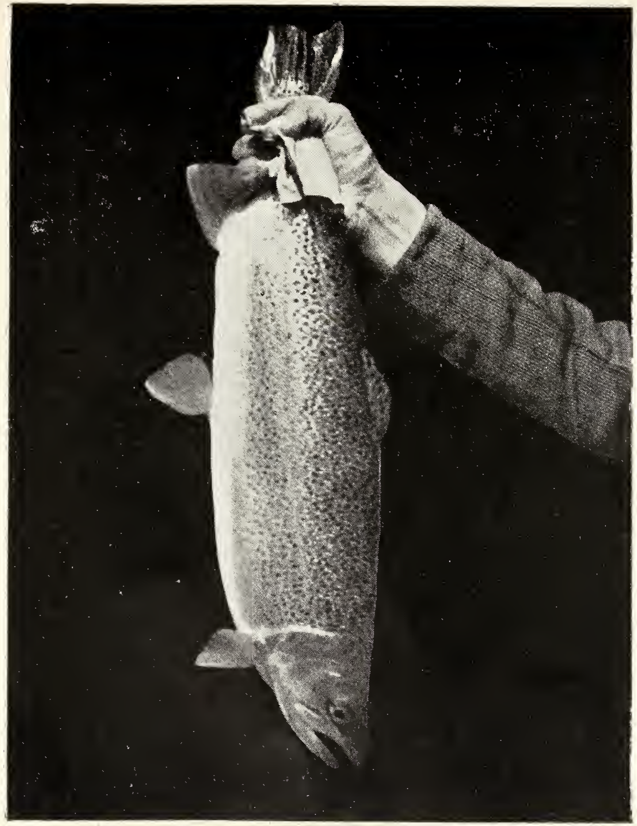
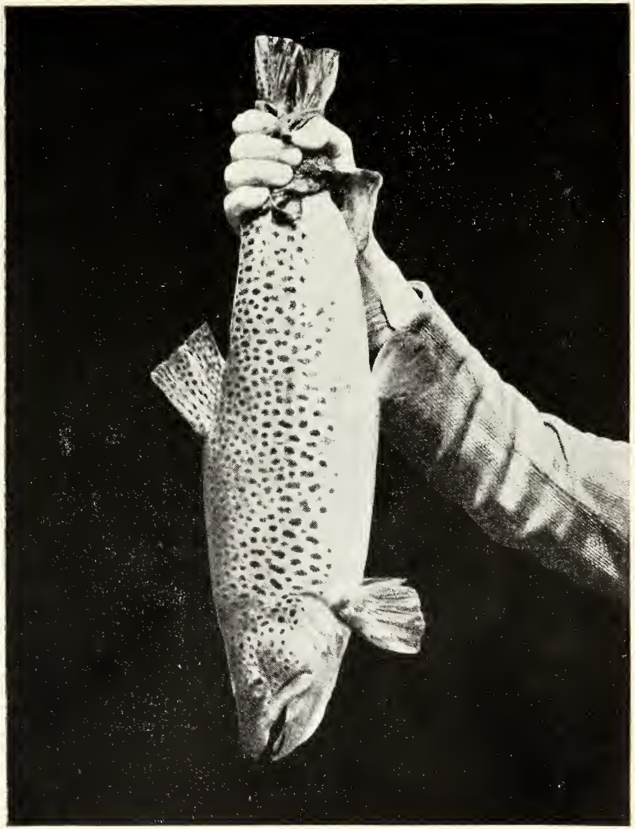
* Reprint from July 1943 No. of *United Service Institute Journal (India)* by Courtesy of the Editor.



RAINBOW TROUT.



BROWN TROUT.

One of the Kulgam trout streams (formerly the preserve of H.H. the Maharajah of Kashmir): some very heavy rainbow and brown trout have been killed on these beats.

The tank at the ancient Moghul gardens at Verinag containing springs which feed the trout stream of that name.

Dispersion.—Rainbow were first exported from the U.S.A. to the United Kingdom in 1882. They also went to other countries in Europe and to the Dominions, and reached New Zealand, Ceylon and India. It is quite possible that among them were the true *S. shasta,* but many must have been the cross between *S. shasta* and the steelhead. The same stories of mysterious disappearances came in from all these countries. Many admitted that they were baffled, so all sorts of theories were put forward to explain how they effected their vanishing trick, when they appeared to be thriving in suitable localities.

Further reports were received later from the countries which had imported these so-called rainbow. Germany, for example, described them as voracious feeders which, having cleared out all the natural food in a pool, would move *downstream* in search of more food. They did not, however, appear to suspect any migratory tendencies to be connected with a natural move towards the sea.

(*a*) Notes from the United Kingdom confirmed that they were heavy feeders and ate nearly twice as much as the brown trout; consequently, if brown trout and rainbow inhabited the same pool, the brown trout stood a small chance of thriving; (*b*) their livers were about three times larger than those of the brown trout; (*c*) given favourable conditions, they gained in weight about one pound a year; (*d*) they did best in alkaline water; (*e*) when netted in, they did their best to escape; (*f*) they were affected by very cold water and invariably tried to escape. They have been known to bury themselves in the muddy bottoms where many died, either from suffocation or from the effects of marsh gas; (*g*) they did quite well in water of about 77°, a temperature that would probably kill brown trout (other writers do not agree, and consider that 70° is reaching the danger mark); (*h*) the average life was about five to six years, when they were inclined to go blind. Several have been dug out of the mud in this condition or caught in nets among the weeds.

Most keen anglers will be able to quote cases from their personal experience regarding the complete disappearance of these fish from a favourable locality a year or two after stocking. The writer recalls a stream-fed lake of about five acres in England, which had a good food supply, but was very deep and cold. It was stocked with rainbow from Blagdon and did reasonably well for two seasons; after this the fish began their vanishing trick, so the lease was terminated. Curiously enough, three seasons after the vacations, one rainbow of about 2 lbs. was taken on a fly.

A friend of the writer diverted a small stream running through his garden into a series of small pools, erecting wire netting at the exit from the garden. Although on high ground near a moor, and thus rather cold, the site was a sunny one; rather shallow with a rocky bottom. Besides natural food, artificial food, such as snails, shrimps, insects and liver, was supplemented. It was stocked with a strictly limited supply of 9-inch rainbow. The owner amused himself by inviting his guests to catch one on a fly for lunch. The rate of growth was far higher than mentioned in para. (*c*) above, some of the fish attaining 7 lbs. in weight in 2½ years. No casualties from natural causes were observed. It was always a matter of interesting conjecture as to what was going to happen to rainbow after they attained a weight of over 7 lbs. Unfortunately, the sudden sale of the property, owing to the untimely death of the owner, prematurely terminated the writer's observations.

The most illuminating and fascinating account of rainbow culture in the East comes from the pen of Mr. Philip Fowke, a former Superintendent of the Ceylon Fishing Club Hatcheries in Newara Eliya, whose research work regarding rainbow places him in the very highest rank of pioneers.

The author gratefully makes acknowledgment to him for his kind permission to disseminate some of the valuable information which he has discovered after years of study and practice. The facts are of such importance that every reader who is interested in rainbow is strongly recommended to acquire his masterly pamphlet, reprinted from the 'Ceylon Journal of Science,' Section C. Fisheries, Vol. VI. Here are a few salient facts:—

Although brown trout were introduced into Ceylon in 1882, rainbow were not imported until 1899 and 1902. They were bred successfully at heights ranging from 7,200 feet to 5,800 feet; below the latter height they were affected by the heat, and it has been found that they will not breed freely below 5,500 feet.

They thrived well, and four years after their introduction, large numbers of really good fish were being killed on fly. They then moved to Lake Gregory, which checked their downward progress and, from the lake, went up to the smaller streams to breed. Those fish, however, which had ready access to the river passed away downstream. In 1903, in the same lake, the biggest rainbow killed (on a worm) was 10 lbs. 9¾ oz. Another, found partly eaten by an otter, was judged to be 18 lbs., but its weight was not officially recorded as it could not be properly weighed. The conclusion drawn was that the more or less pure *S. shasta* were content to stay in the rivers, whereas the Steelhead variety invariably made for the sea when they had attained a weight of about 5 lbs.

Later, indisputable evidence was received that large rainbow (so-called) were being caught miles away in the lower reaches of the rivers down to 1,500 feet, negotiating as they went most formidable falls in which one would expect a fish to be dashed to pieces. The point is that they survived; consequently, it may be assumed that these fish would have little difficulty in overcoming the rapids of such rivers as the Beas or Jhelum, where the dangers would be infinitely less, even during the heavy spates; besides which the temperatures, especially during the cold weather, would be considerably lower than those pertaining in Ceylon.

It has already been mentioned that scale and vertebrae counts of Dr. Kendall were:—

(*a*) True (river) rainbow (*S. shasta*) lateral line count of scales 160—vertebrae 63; (*b*) steelhead scale count 130—vertebrae 60.

In order to test the new theory, Mr. Fowke went to the Natural History Museum, South Kensington, and asked the authorities to show him a marine-run steelhead trout; he was shown a perfectly preserved Ceylon 'rainbow' trout! He next asked Mr. Donald Carr to give him a scale-reading of some of the famous rainbow at Blagdon. The lateral line count of scales given was 139, 139, 140, 140 and one of 145. Finally, he sent three Ceylon rainbow for scientific examination; the result of the scale count was 138, 127-128 and 132-134, with the vertebrae never more than 60.

To check this point, Mr. Fowke wrote to America asking whether the so-called rainbow in Ceylon were not really steelheads. The reply confirmed that it was very difficult to differentiate between the two, up to a pound or two in weight, but that the average size of the true steelhead seldom exceeded 6 to 8 lbs. in weight. This confirmed Mr. Fowke's experience, for he put the weight of the average river (Ceylon) rainbow at 6 lbs., and had been unable to trace any river rainbow being taken over 7 lbs.

The result of these tests seems to prove that all these so-called rainbow were really steelheads, hence their migratory propensities.

Mr. Fowke also mentions that, in 1935, Dr. H. S. Davis, of the U.S. Bureau of Fisheries, wrote to him saying that they were rearing several strains of rainbow in America, hoping to establish one whose habits would be no more migratory than those of the brown trout. If this enterprise succeeds, it should be very interesting indeed to all fishermen. Unfortunately, in these days it is very difficult to get up-to-date information in India, but it is quite possible that these experiments may have been crowned with success. Should this be the case, it would be interesting to stock some virgin water with these non-migratory rainbow. All evidence received heretofore seems to confirm that hybrid stock having any connection with the steelhead rapidly adopts migratory tendencies until the whole stock is lost, unless it inhabits some land-locked lake.

If this theory is correct, then the very distinctive markings of the steelhead should make recognition an easy matter, even to unsophisticated villagers. Further, if these fish really are going down to the sea, stocks put down in Kashmir, Kulu, the Nilgiris and elsewhere should be filtering into the larger rivers of India, and already may have been netted hundreds of miles away from their hatcheries.

In order to produce further evidence, the writer corresponded with various Game Wardens and Pisciculturists in India, to whom he makes grateful acknowledgment for the trouble they have taken in sending him the following details.

Kashmir.—Characteristic disappearance was observed, although rainbow did well in the deep pools near the stewponds at Harwan Hatcheries up to from 5 lbs. to 7 lbs. In certain streams where they were put down, they were prevented from moving downstream by grids and gratings. In such cases the fish became emaciated, and some deformed. In other cases they did well, fish of from 4 lbs. to 5 lbs. being taken. There was a tendency for them to move down to the deep, low-level lakes (such as the Dal, Anchar and Wullar lakes). Some of the Kashmir stock was sent to Kulu.

The opinion of Mr. G. M. Malik, M.SC., the Pisciculturist at the Achabal Trout Culture farm, is that the Kashmir rainbow resembles *S. gairdnerii.* This point was confirmed when a specimen was sent home to Mr. J. R. Norman of the British Natural History Museum.

Confirmation has later been received that the so-called rainbow is being caught miles below the streams in which they were liberated or bred. In 1942, one rainbow of 3 lbs. was caught on rod and line three miles below Baramulla; consequently the confirmatory evidence which was anticipated, is now coming to hand. Further enquiries are, however, being made, and it is hoped that in a few years' time, much more data will become available.

Scale counts of rainbow at Achabal and Harwan gave the following details: (*a*) Lateral line: vary from about 132 to 138. (*b*) Vertebrae 60. These figures have been taken from the measurements of a large number of fish at both the above hatcheries.

Nilgiris.—In the Nilgiris the same difficulties were encountered in breeding brown trout as those experienced in Ceylon, namely the spawning of the hens never synchronized with the milt of the cock fish; consequently rainbow were introduced.

I am indebted to Mr. P. W. Davis, M.C., I.F.S., Hon. Secretary of the Nilgiris Game Association, for the following notes:—

'Regarding migration, it may be assumed that rainbow do (or did) get over the falls into the Bhavani and Moyar rivers, but—as purely negative evidence counts—I believe that no trout has been picked out of the rivers in the low country. There are also mahseer in both the above rivers which eventually join the Cauvery and flow across Southern India to Tanjore. I doubt that the Nilgiri trout finds its way very far to the sea. The Pykara Hydro-Electric Works now tend to prevent any fish getting below, as they are held in the Mukerti and Glen Morgan Reservoirs.

"I and a Committee member, separately, counted the lateral (line) scales of two fish—one a 2-pounder and the other about 1½ lbs. The extraordinary thing is that they came out differently! The scale count of the larger fish was 126 or 127 and the vertibrae count was 61. The smaller fish was more difficult, even under a glass, as scales were small and indistinct, but different counts totalled 147 and 149...... (vertebrae not mentioned.)

'Mr Fraser, for many years Fisheries Superintendent of the Nilgiris Game Association, writes to me:

' "I took it (scale count) up with the experts in California, and we sent sample fish to California in formalin for identification. I cannot, however, remember the number of scales, but there is no doubt that the fish, in the Nilgiris rivers is the 'steelhead'—*Salmo irideus.*" '

Kulu.—To Mr. T. Tyson, of Katrain, one of the best-known resident fishermen in Kulu, and who has long experience of those waters, I am grateful for the following notes:

'Years ago, I fished the river (Beas) almost down to Mandi, but caught no trout of any description below Bajoura (about 12 miles below the fishing reserve).

'Rainbow have now practically disappeared from the Beas. Up to about 12 years ago, I occasionally caught them around Katrain, but during the whole of the last season (1942), I don't think any were landed in the fishing reserve.

'From my experience of rainbow in Kulu, the fighting qualities of the species gradually deteriorated. Years ago, shortly after they were introduced into the Beas, one could almost invariably "sense" a Rainbow while playing it. In more recent years, however, there was very little to distinguish its fight with that of a brown trout.' (A most interesting observation; corroboration from other waters would be of value.—*Author.*)

I also appreciate the help given me by Dr. Hamid Khan Bhatti, M.SC., PH.D., Game Warden of the Punjab, who writes:—

'It has been found that rainbow trout does not exist in the lower reaches of the River Beas beyond the Kulu Valley. It is, therefore, doubtful whether these fish have made way to the sea or have otherwise disappeared. The lateral line count is 134.

'It is sad to relate that a very heavy flood swept through the Valley in August, 1942, and killed thousands of trout, both in the river and in the hatcheries. The extent of the damage was very marked throughout the 1943 season and again in March 1944.'

Travancore.—Mr. W. S. S. Mackay also kindly sent some very interesting notes on the High Range Angling Association of which he is Honorary Secretary.

This is a purely private Association, and is *not* open to the public. As in other places in South India and Ceylon, brown trout having failed (introduced 1906) owing to the male and female not coming into season together, rainbow were introduced from stock taken from the Nilgiris, and also from Ceylon. Some of this strain originated from Germany, New Zealand and Kashmir, so there is a good mixture of blood. Mr. Mackay states that the scale counts have never exceeded 140, and that the fish are steelheads and not rainbow.

There have been considerable losses of stock in the past, as these trout seemed to make their way down to the warmer waters of the foothills, and to die there. Lt.-Col. Stockley, however, states that rainbow will live in waters at 2,000 feet in Africa.

There were the usual setbacks and failures at the initial stages, but Mr. Mackay relates that when these rainbow were put into a small pond or lake, where the food supply was good, they had a phenomenal increase in weight from 2 lbs. to even 3 lbs. a year; but they ceased to rise to fly after the first year and usually died prematurely. They did very well in clean, running water where there was plenty of space. Their voracious and migratory tendencies were very marked.

Mr. Mackay attributes the failures in breeding to the high temperatures, it being clearly established that they would not breed well much below 5,000 ft. They did well, however, at Hamilton's Plateau (7,500 ft.), and Mr. Mackay has now had the satisfaction of hatching out his own trout. Some nice fish are being taken weighing from 3 to 5 lbs. Mr. Mackay, later, sent me a photograph of a two-year-old rainbow, length 25½ inches, girth 15½ inches, weight 8 lbs. This seems to be very exceptional growth. He remarked that the fish was spawn-bound, and picked up dead. An Air Force officer records that some rainbow were being taken in a river above which was a waterfall having a sheer drop of 400 ft., only the upper waters had been stocked, so this falls into line with the reports emanating from Ceylon.

Here, then, is some of the evidence on the rainbow-steelhead controversy, regarding which the reader can draw his own conclusions.

Probably a great deal more could be discovered concerning the migration of these so-called rainbow. Members who are keen anglers are scattered over the length and breadth of the country. It seems quite possible that, if enquiries were made on rivers perhaps hundreds of miles below preserved trout waters, they might result in the identification of these wanderers, either after being trapped in the village nets, or even caught on rod and line. If such an event did occur, it would be of considerable interest to other anglers, and a communication to the author would be greatly appreciated.

The problem to be solved is: where does the rainbow end? The answer seems to be: in the sea, if he can ever get there—poor devil.

OCCURRENCE OF BIRDS IN MADURA DISTRICT.

BY

EDWARD G. NICHOLS.

This is the first attempt to make a list of all the species of birds known to occur in Madura District, South India. The books on the subject are all vague with regard to distribution and relative abundance and altitudinal range. I hope these notes, which are a digest of many volumes of notes, will help compilers of future books to be a little more specific on some of these matters.

Madura District has seen few ornithologists. The great pioneer of South Indian birds, Dr. T. C. Jerdon, seems to have visited Madura City once or twice on his way from Trichinopoly to Tirunelveli, but he did not stop to collect here. Rev. S. B. Fairbank and Capt. Horace Terry did good work collecting on the Palni Hills, and the former also took a few specimens on the plains. Mr. Sālim Ali's Travancore Survey worked along our western border, and from his list I have borrowed all records for Kumili and for Periyār Lake and its environs, because Madura District has about half a mile of shore-line on the lake at a place called Thēkadi near Kumili. Others who have done bird work in the District and whose specimens or records have helped me are: Major Campbell, on the Palni Hills in the 1830's; J. P. Cook, on the Palni Hills, at Kuruvanūtthu, and at Thēkadi from 1893 to 1896; R. F. Stoney, at Kodaikānal in 1899, and on the plains in 1903-4, 1915, and 1917; Dr. C. B. Harrison, at Madura in 1907; S. H. Prater, on the High Wavy Mts. in 1917; and C. McCann, on the Palni Hills in 1921. There are some local specimens in the Zoölogy Dept. of the American College, Madura. Mrs. Cantlay has sent me a good list of species observed on the High Wavy Mts., and various friends have given me occasional sight records. My own observations started in 1921-3, mostly at Kodaikānal. Since 1930, I have lived on the plains, stayed at Kodaikānal several weeks each year, and visited briefly most parts of the District. In my spare time I have accumulated all the records I could with the use of binoculars.

Madura District is in the middle of Tamil Nādu. It extends from 9° 31′ to 10° 44′ North, and its southern point is for a bird only 102 miles from Cape Comorin. On its eastern side it is at one point only 42 miles from Palk Bay. And its western point is 58 miles from the Indian Ocean.

While they are not sharply cut off from one another, there are different kinds of bird habitat in the District, which we may distinguish as follows:

1. The Coromandel *plains* sweep into Madura District from the north and east and south, and flow like a dry sea around the base of the hills. Roughly two-thirds of the District is plains, almost flat, but rising gently from 300 ft. above sea near Tirumangalam to over 1,500 ft. at Kūdalūr in the Kambam valley. There is very

little difference between the bird-life in different localities on the plains, but four kinds of habitat may be noted :

(*a*) For a large part of each year, the plains are fairly dry. Trees of many kinds are thinly scattered over them. The rainfall averages as low as 26 inches at Palni, and much of it falls from September to November. A bird partial to the *dry plains* only, is the Yellow-wattled Lapwing.

(*b*) There are small areas of *scrub jungle* and bushy waste-land on the little hills that rise here and there out of the plains, and at the base of the large mountain masses. Most of the birds of the dry plains are found in the scrub jungle in numbers, but the latter is particularly the home of the Jungle Warbler, the Malkoha, the Jungle Quail, and the Gray Partridge.

(*c*) Next there is the *wet zone.* If the north-east rains are good, much of the area of the plains comes for the season temporarily under this head, and all the irrigation tanks will have water in them for three or four months. But, the rains are irregular, and so the best place to look for the wet zone is on the lower Vaihai plains near Madura City, which is served by the Periyār irrigation system from about June 15th to March 15th every year. The wet rice fields attract such birds as the Streaked Warbler, the Greater Spotted Eagle, and the Marsh Harrier.

(*d*) A few *large tanks* within the irrigated area have water in them for more than nine months of the year. Toward the end of this period, they have a thick growth of lotus, water-weeds, and sedges. Most of the water-birds naturally seek out such places, and there we find the Water Hens, Cormorants, Storks, large Herons, and Teals. But I have not yet found a heronry in the District.

2. Leaving the plains, we start up through the *dry hill slopes*, including the lower slopes of the Palni Hills where trees are small and few, and also the Varusha Nādu or upper Vaihai valley, the Andippatti Hills, the Sirumalai slopes, and the lower hills flanking the Sirumalai. Peculiar to this zone are the Sirkeer Cuckoo and the Pea Fowl.

3. Higher up, we come to the tropical *rain-forest.* It surrounds Periyār Lake at the south-western corner of the District, and occurs on the High Wavy Mts. It folds itself around the slopes of the Kannan Dēvan Hills High Range, where Madura District includes a corner of that range. From there north-eastward there are larger or smaller blankets of forest on the Palni Hills, but the Lower Palnis, on their 4,000-foot plateau, show the forest at its best. And it jumps across the ten-mile gap of plains to rest again on the summit of the Sirumalai. Where it is cultivated, this zone has plantations of plantains, coffee, cardamoms, oranges, tea, etc. Birds peculiar to it are numerous; the Spotted Babbler, the Gold-fronted Chloropsis, the Black-naped Flycatcher, the Malabar Wood Shrike, the Racket-tailed Drongo, the Fairy Bluebird, the Grackle, and the Trogon, are a few of them.

4. Finally, there are the *temperate hill-tops.* From about 5000′ up to the highest level in the District (8724′ on the edge of the Kannan Dēvan Hills) there are open downs varied with small patches of woods called *sholas.* The rainfall is 65 inches yearly at

Kodaikānal. To this zone are confined such birds as the Kodaikānal Laughing Thrush, the Shortwing, the Blackbird, the Red-headed Warbler, the House Swallow, the Jungle Nightjar, and the Painted Quail.

Considering the variety of life-zones in the District, it is not surprising to find that 331 species occur here out of a possible total of about 490 species in the whole of South India. Our great deficiency is in water-birds, for Madura District has 77% of the land-birds of South India, but only 45% of the water-birds.

The number of species found at each elevation in the District is approximately as follows:

5,000′ and above	...	141
3,000′ to 5.000′	...	187
1,000′ to 3,000′	...	195
Plains	...	204

Out of our 331 species, I guess that 210 are permanent residents in some part of the District, 109 are winter visitors, and 2 (the White Ibis and Black-necked Stork) are summer wanderers. Of the winter visitors, some are water-birds that breed in winter, and so the number of species that breed in the District is probably over 220. There are curious gaps in my records of some of the Munias and Swifts, which may perhaps leave the District for part of the year.

The length of stay of our winter visitors varies greatly. A few species have been noted only in passage to and from Ceylon or Tirunelveli District, and these swell the figures for March. It is surprising to find that in an area so near the Equator the majority of winter visitors spend 5½ months in Madura District, from mid-October to the latter part of March. The total number of winter visitors found in the District during each half-month is:

July	2nd	half	6	Dec.	2nd	half	65
Aug.	1st	,,	13	Jan.	1st	,,	66
,,	2nd	,,	16	,,	2nd	,,	67
Sept.	1st	,,	28	Feb.	1st	,,	65
,,	2nd	,,	32	,,	2nd	,,	62
Oct.	1st	,,	40	Mar.	1st	,,	63
,,	2nd	,,	55	,,	2nd	,,	62
Nov.	1st	,,	54	Apr.	1st	,,	50
,,	2nd	,,	61	,,	2nd	,,	27
Dec.	1st	,,	62	May	1st	,,	9

In the following list, the English names are the briefest I could find to distinguish the birds in our District from one another.

Tamil names have been printed only once, but apply to several species in most cases. If a species has no Tamil name next to it, the next previous Tamil name may be found applicable. The most helpful man on this subject is Mr. Bonavis Bonnell, M.A., Lecturer in Zoölogy at Madras Christian College.

In each case where I have used the third scientific name, I have done so to indicate that specimens have been taken in Madura District and the subspecies has been determined. Since the published lists are not always clear on this point, I cannot vouch for the accuracy of the determination in all cases. If no specimen from Madura District has been scientifically determined, I have added a note to show the nearest place where the subspecies has been determined from specimens.

Records in parentheses are those from nearby Districts which improve upon the Madura District records, either in altitudinal range or in duration of stay.

The following 'farthest south' records are found in this list: Gray Babbler, Redstart, Orphean Warbler, Wire-tailed Swallow, Short-toed Lark, Singing Bush Lark, Griffon Vulture* and Tawny Eagle.

Corvus macrorhynchus. Black Crow. Tamil: *Andan kākai, Karun kākai.*

The subspecies is probably *culminatus*, which has been secured in Salem Dist. and in Travancore.

Plains, and around Thēkadi, 3000′. Fairbank also found this crow around some of the villages of the Upper Palni Hills as high as Vilpatti, 5800′. (In the Nīlgiris up to 7200′.)

Resident.

It ranks 8th in abundance among the plains-birds, and is about one-fourth as numerous in my records as the House Crow. It avoids dense jungle, but is more a bird of the open country and the edge of the village. Its voice is lower in pitch than the House Crow's.

Corvus splendens. House Crow. *Maniyan kākai.*

Specimens of *splendens* have been taken in Trichinopoly Dist., and of *protegatus* in Travancore.

Plains only. (It ascends the Nīlgiri hills.)

Resident.

Ranks first among the plains-birds. It is found not only around houses, but also in remote fields and along the shores of tanks.

Dendrocitta vagabunda parvula. Indian Pie. *Vāl kākai.*

The subspecies *vernayi* has been taken in Salem Dist., and I suspect our plains-birds belong to it.

Plains, and lower hills as high as 5000′.

Resident.

Fairly common, wherever there are sizable trees. As many as 10 may be seen together. Its trumpet-like calls are various, most often of 2 or 3 ascending notes: *ku-hee* or *ku-lo-hee.*

Dendrocitta leucogastra. Southern Pie.

J. P. Cook took a specimen at Thēkadi, 3000′. (In other districts, it occurs in damp forests up to 5000′.)

Parus major stupae. Gray Tit. *Pattāni kuruvi.*

From 1000′ up to 7000′ in all the hills. (From sea-level at Madras.)

Resident.

Rare, usually found in tree-tops on the edge of forest. Its clear, loud notes are somewhat less shrill than a Sun-bird's, usually 3 notes in a phrase.

Machlolophus xanthogenys travancoreensis. Yellow-cheeked Tit.

From 3000′ to the top of the western hills. (Down to 2000′ elsewhere.)

Resident.

Fairly common, in parties up to 10 in number, in trees. Its notes are loud and cheerful, usually of 3 syllables, much like the Gray-headed Flycatcher's in quality.

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*Probably Long-billed Vulture (*G, indicus*) Eds.

Sitta frontalis frontalis. Velvet-fronted Nuthatch. *Pasai edukira kuruvi.*

Hills, from the base (Fairbank), to the top.
Resident.
Common in forests of the lower hills, fairly common at the top. Often found in groups of about 12, on the bark of large trees.

Garrulax delesserti. Wynaad Laughing Thrush. *Pūn kuruvi.*

The late Mr. F. Dawson found a nest near Pillar Rocks in 1935, and was sure that the bird was a Laughing Thrush without a white eyebrow. I have only one imperfect observation, also above 7000′. (Occurs in thick forest at all elevations in other districts.)

Trochalopterum jerdoni fairbanki. Kodaikānal Laughing Thrush.

Western hills, from 3500′ up. (As low as 3000′ in the Ānaimalais.)
Resident.
Abundant, ranking 3rd among Kodaikānal birds. Rev. S. B. Fairbank discovered this subspecies at Kodaikānal in 1867. It skulks in thick shrubbery. The notes are loud and ringing. The laugh is a deliberate *har, har, har. . .* A common call is *ku-hi-yu*, repeated several times. A low-pitched scolding resembles that of the Red-whiskered Bulbul.

Turdoides somervillei malabaricus. Jungle Babbler. *Thavittu kuruvi, Pandri kuruvi.*

Birds of the eastern plains are noticeably paler, and probably belong to the race *orientalis*, which has been taken in Mysore.
Plains, and up to 6100′ in the hills. (In other districts up to 6500′.)
Resident. Terry found a nest at Pallangi, 5500′.
Fairly common. Flocks of about 7 are found where there are plenty of shade-trees and bushes on the plains. In the lower hills I have seen flocks of about 25. On the plains, I have heard little screams, and a series of squeaky whistles in descending scale. In the hills, the notes are much louder and harsher, and remind one of fruit-bats.

Argya caudata caudata. Long-tailed Babbler.

Plains, and up to 1200′ in the hills. Found near Ātthūr, near Nilakōttai, and scattered from these points south-westward to the foot of the High Wavy Mts. (As high as 2500′ in Mysore.)
Resident.
Uncommon, in flocks of about 10, in scrub jungle or rows of bushes between fields.

Argya malcolmi. Gray Babbler.

Lower Palni Hills, from 2800′ to 5000′. This is the southern limit of the species.
Resident.
Fairly common. Terry obtained a specimen on the northern slope near Palni. In small flocks in open bushy places.

Argya subrufa. Rufous Babbler.

A specimen has been taken at Thēkadi, 3000′. Bunker and I saw three at Pallangi, 5400′. (In other districts it is resident from 200′.)

Pomatorhinus horsfieldii travancoreensis. Scimitar Babbler.

Possibly our Sirumalai birds belong to the form *maderaspatensis*, which has been taken in Salem Dist.
From 1500′ to the top of all the hills.
Resident.
Common at Kodaikānal. Found in underbrush and the lower branches, in thick forest, often in parties of about 5. The 3 or 4 notes on the same pitch are almost Barbet-like in tone. The call is a rattling note louder than that of the Laughing Thrush.

Dumetia hyperythra albogularis. White-throated Babbler.

From 1200′ up to 4600′ in the Palni and Sirumalai Hills. (In other districts it occurs lower, and also as high as 6000′.)
Resident.
Uncommon, in small groups in dense thickets. I have heard a clear whistled song of 7 notes, a tittering call, and a soft *tack-tack* like two pebbles tapped together.

Chrysomma sinensis. Yellow-eyed Babbler.

Specimens taken in Salem Dist. belong to the typical *sinensis*.
From the base of the hills up to 3800′. (In the Nilgiris as high as 6500′.)
Resident.
Uncommon, but a little more common than the White-throated. Found in parties of up to 8 birds, in scrub jungle. I have heard a low-pitched twittering warble, some clear Iora-like whistles, and a low chirping.

Pellorneum ruficeps. Spotted Babbler. *Saruhunni kuruvi.*

Travancore specimens belong to the race *granti*, but those from Salem Dist. are of the typical *ruficeps*.
From the base of the hills up to 6200′.
Resident.
Fairly common. They are shy birds, seen singly in thick undergrowth usually on the ground. A common call: 'I'm *right* here', is tiresomely repeated, like an Iora. A song consists of loud clear notes in descending scale: 'He did, he did, he did do that', repeated two or three times.

Alcippe poioicephala poioicephala. Quaker Babbler.

In the western hills from 2200′ to 6000′. (From the plains to 7000′ in other districts.)
Resident.
Fairly common in my records, common on the High Wavy Mts. according to Mrs. Cantlay. As many as 8 together, among the branches on the edge of dense forest. The song is a cheerful, clear warble of about 10 notes, almost oriole-like.

Rhopocichla atriceps bourdilloni. Black-fronted Babbler.

Hills, from 1000′ to 5000′. (In other districts as high as 6000′.)
Resident.
Uncommon, found in groups of about 12, in dense thickets.

Aegithina tiphia multicolor. Iora. *Māmbala chittu.*

The Central Indian race, *humei*, has been taken in Salem District, and probably occurs on our plains.
Plains, and in the hills as high as 4800′. (In other districts as high as 5500′.)
Resident.
Common, in shady trees.

Chloropsis aurifrons. Gold-fronted Chloropsis. *Pachai kuruvi.*

Sālim Ali took specimens of the Ceylon race, *insularis*, in Travancore.
Western hills, from 1800′ to 4000′. (Elsewhere, from 200′ to 4500′.)
Resident.
Rare, in thick trees.

Chloropsis jerdoni. Jerdon's Chloropsis.

Plains, and up to 4800′ in the hills, where Fairbank obtained a specimen and I also have observed them well.
Resident.
Uncommon. Found usually in small flocks in groves of mango and other thick trees.

Microscelis psaroides ganeesa. *Karuppu kondai kuruvi.* Black Bulbul.

Western hills, from 2400′ up to the hill-tops. (In other districts, as low as the foot of the hills.)

Resident.

Common, in flocks of up to 40, in the tops of tall trees far from houses. One call often heard is: *chirp, chee-chee-chee.*

Molpastes cafer cafer. Ceylon Bulbul. *Kondai kuruvi.*

Plains, and up to 6500′ in the hills near Kodaikānal.

Fairbank, Terry, and Dawson found it occasionally at the top.

Resident.

Abundant, ranking 4th among our plains-birds. Found wherever there are small trees and bushes.

Otocompsa jocosa. Red-whiskered Bulbul.

Specimens from Rāmēswaram and Travancore indicate that our subspecies is *fuscicaudata.*

At all levels on the hills only. (In Rāmnād and Chingleput Districts it occurs also at sea-level.)

Resident.

Abundant on the higher hills, being first on the list at Kodaikānal. More numerous than the Ceylon Bulbul in most places in the lower hills. At the base, I have found it rarely in winter. Occurs in bushes in open places.

Iole icterica. Yellow-browed Bulbul.

From 1000′ to 7200′ in the hills. (A specimen has been taken at sea-level on Rāmēswaram Island by Biddulph.)

Resident.

Fairly common, in flocks of about 40, in tree-tops in forests.

Pycnonotus xantholaemus. Yellow-throated Bulbul.

Lower Palni Hills, from 2000′ to 4000′. (As high as 5000′ according to Stuart Baker.)

Probably resident.

I had a good observation of a group of 4 in thick undergrowth on Sep. 18. Rare.

Pycnonotus gularis. Ruby-throated Bulbul.

Western hills, from 2400′ to 3500′. (Records in other districts range from the foot of the hills up to 3750′.)

Resident.

Rare, in thick undergrowth.

Pycnonotus luteolus luteolus. White-browed Bulbul. *Manjat kondai kuruvi.*

At Palni, I have seen this species on the plains 5 miles away from the foot of the hills. On the thinly-wooded slopes of the Sirumalai, it is found nearly up to 4000′. (Occurs at sea-level at Madras.)

Resident.

Common in dense scrub, though it avoids observation by staying in the center of bushes. The whistled notes are loud, tumbling, almost explosive.

Microtarsus poioicephalus. Gray-headed Bulbul.

On the Palni Hills between 2400′ and 3500.′ (From 2000′ to 4000′ in other districts.)

Resident.

Rare. I have only 3 records, in the densest thickets.

Brachypteryx major albiventris. Shortwing. *Kurun jettai kuruvi.*

From 5400′ to the top of the Palni Hills. (In Travancore it occurs as low as 3000′.)

Resident.

Fairly common at Kodaikānal, where Rev. S. B. Fairbank discovered the subspecies in 1867. It occurs in dense forest, in bushes, rarely higher than 10 feet above the ground. About sunset it comes out into the open more. The song is higher and lighter than the Blackbird's. In contrast with the tame, mechanical effort of the Nīlgiri Flycatcher, the Shortwing's song is wild and woody.

Tarsiger brunnea brunnea. Blue Chat.

My own record was at 1400′ on the slope of the Lower Palni Hills. Sālim Ali took a specimen at Kumili, 3000′. (In other districts it occurs up to 5000′.)

Winter visitor. My record was on April 10. (Elsewhere it stays from mid-October to May.)

Rare.

Saxicola caprata nilgiriensis. Pied Bush Chat. *Kallu kuruvi.*

Specimens of the typical *caprata* have been obtained in Salem District, and so it may occur in the north-eastern part of Madura District.

I have seen birds on six occasions on the plains as low as 700′, between July 7 and September 12 only. Otherwise, it is confined to the hilltops, and the open grassy slopes. (In Chingleput District, this species is found at sea-level all year.)

Resident on the hills.

Abundant at Kodaikānal, ranking 6th in my records. Rare below 4000′.

Phoenicurus ochruros. Redstart.

A specimen from the Nīlgiris is assigned to the form *rufiventris*.

Plains, and up to 2800′ in the Lower Palni Hills. (2900′ in Mysore.)

Winter visitor, from Nov. 4 to Feb. 1. This is the southern limit of the range.

Rare. The call is a rapid series of about 6 chattering notes with a little squeak in them.

Saxicoloides fulicata fulicata. Indian Robin. *Kari kuruvi.*

Fairbank secured a specimen at the eastern base of the Palni Hills. The Pondicherry form, *ptymatura*, may perhaps occur on the plains in the eastern part of the district.

Plains, and up to 2000′ in the hills. (Up to 6000′ in other districts.)

Resident.

Common, especially in scrub jungle. The song is of 4 to 8 notes, shrill whistles gliding into each other, more wiry and less varied than the Magpie-Robin's.

Copsychus saularis. Magpie-Robin. *Pātkāri kuruvi.*

Specimens from Salem District belong to the typical *saularis*, while those from Rāmēswaram and Travancore belong to *ceylonensis*.

Plains, and up to 7000′ in the hills, where a few are found at Kodaikānal.

Resident.

Common at the foot of the hills and in the lower hills, rare on the plains. Found among heavy trees in well-watered places.

Kittacincla malabarica. Shama Thrush. *Sōlai pādi.*

Specimens from Salem District and from Travancore belong to the typical form.

Between 1000′ and 2000′. (Stuart Baker says 4000′ is the upper limit.)

Resident.

Uncommon, in damp, dusky glades,—for example, along the pilgrim path on Alahar Malai. The song has the strength and vivacity, and much of the sweetness, of the Nightingale's.

Turdus simillimus bourdilloni. Blackbird. *Karun kuruvi.*

Palni Hills birds have the bill orange-red, the eye-ring a little duller, and the legs dusky-orange. Mr. Whistler says they are nearer to the Travancore than to the Nīlgiri race, *simillimus*. Dr. T. C. Jerdon said he had a specimen given to him by Major Campbell, who shot it on the Palni Hills, which did not differ from the typical *similimus*. Terry thought he observed also the Black-capped subspecies, *mahrattensis*, and this is possible as a winter visitor, because specimens have been taken in Travancore.

From 3000′ to the top of the hills. (In other districts down to 2500′.)

Resident.

Abundant on the higher hills, ranking 9th at Kodaikānal. Found in trees near houses, and also in remote shōlas. One form of song begins with 5 descending notes at intervals of half a tone. Often there is a combination of a long syllable next to a short one, as *coo-leeee* or *Eva*.

Geokichla wardii. Pied Thrush.

From 4000′ to 7000′ on the western hills. (May occur also on the plains.)

Noted only in March in migration. (Judging by records from other districts it should be found in October on its southward journey. Till April 7 in Mysore.)

Rare.

Geokichla citrina. White-throated Thrush.

The subspecies *cyanotis* has been taken in Salem District and in Travancore.

With S. K. Bunker, I saw one singing in a cardomom forest at 4200′ in the Lower Palni Hills. (From 200′ to 5000′ in other districts.)

Probably resident.

The song is clear, loud, and vigorous, with some phrases very high-pitched.

Oreocincla dauma neilghiriensis. Mountain Thrush.

Western hills from 5000′ to 7000′. (From 2000′ up in the Nīlgiris.)

Resident. Terry found a nest at Kodaikānal on June 7th. Mrs. Cantlay heard one singing on the High Wavy Mts.

Rare. I have seen only one.

Monticola cinclorhyncha. Blue-headed Thrush.

Western hills, from 3000′ at Thēkadi up to 7800′ near Kodaikānal. (Down to 2000′ in N. Kanara.)

Winter visitor: October 23 to February 29. It should stay from early October to March 25.)

Rare.

Monticola solitaria. Blue Thrush.

Travancore specimens belong to the *pandoo* race.

From 900′ to 7000′ in the hills. (I have seen it at sea-level at Cape Comorin.)

Winter visitor, from September 28 to April 6, the latter by Bates. (April 21 is the departure date in Travancore.)

Rare. Single birds are fond of perching on rocks on the open slopes.

Myophonus horsfieldii. Whistling Thrush. *Sīkāram.*

Western hills, from 1500′ to 7500′. (In Travancore it occurs down to 500′.)

Resident.

Very common on the High Wavy Mts., according to Mrs. Cantlay. Fairly common along streams in the lower hills elsewhere.

Muscicapa parva albicilla. Red-breasted Flycatcher. *I pidippōn.*

Plains, and up to 7000′ in the hills.

Winter visitor, from October 26 to April 4.

Rare in my experience, but Biddulph found it frequent. It is seen making short dashes from the lower branches of trees in open places. I have heard a long, somewhat squeaky, whisper-song; also, a low chattering trill; and a double *cluck* like hitting together two stones.

Muscicapula pallipes pallipes. White-bellied Flycatcher.

I have a few records in a dense grove along the Vaihai River near Karuppatti, elevation 500′, from November 10 to February 14. In the lower hills it is found as high as 5500′. (Outside our district it has been noted as high as 6000′.)

Resident in the hills.

Uncommon, in undergrowth in thick woods. The song is high-pitched, so emphatic it is a little squeaky, divided into phrases of as many as 9 notes. I have heard 2 soft, tremulous notes, the second slightly lower in pitch; also a double call a little like the nasal call of the Paradise.

Muscicapula rubeculoides. Blue-throated Flycatcher.

The typical form has been obtained in Travancore.

I have seen only one bird, at 1500′ on the northern slope of the Lower Palnis, April 10. It was in woods, close to the ground. (In Ceylon it occurs on plains and hills.)

Migrant. (Arrives in Ceylon in October.)

Muscicapula tickelliae tickelliae. Indian Blue Flycatcher.

1000′ to 5400′, and Fairbank recorded it also at the top of the Palni Hills. (Elsewhere, it has been found down to 200′ elevation.)

Resident.

Uncommon, in thick bushes in or near forests. Its shrill song consists of 8 or 10 notes, a little richer in tone than the Gray-headed's, with a tendency to rise toward the end.

Eumyias albicaudata. Nīlgiri Flycatcher.

From 4200′ to the top of the western hills. (In other districts it occurs as low as 2000′.)

Resident.

Common at Kodaikānal, in the lower branches of large trees, and in bushes in shōlas. The call is a series of 4 or 5 sharp *chip's*.

Alseonax latirostris. Brown Flycatcher.

Plains, and up to 5000′ in the hills.

Winter visitor, from July 29 to April 10 and rarely resident.

Fairly common, in trees. I have heard a weak whisper-song full of trills and squeaks. The call is 3 or 4 *chick's* in rapid succession, or a small, shrill squeak.

Alseonax ruficaudus. Rufous-tailed Flycatcher.

Sālim Ali took a specimen at Thēkadi, 3000′. (In Travancore, the range is from 2000′ to 3500′ elevation, and the stay is from November 27 to February 28.)

Alseonax muttui. Layard's Flycatcher.

Specimens from Travancore are assigned to the typical race.

I have one probable record, in the Lower Palnis on April 10. (In Travancore from 200′ to 5500′, between October and June.)

Ochromela nigrorufa. Black and Orange Flycatcher.

Western hills, from 4500′ to the top. (As low as 2500′ elsewhere.)

Resident.

Fairly common, in undergrowth in dense woods.

Culicicapa ceylonensis ceylonensis. Gray-headed Flycatcher.

From 2600′ to the top of the hills. (In other districts down to 1000′.)

Resident.

Common. Active in the middle branches and open glades of forests. The head is not gray but dark-blue.

Tchitrea paradisi paradisi. Paradise Flycatcher. *Vāl kuruvi.*

Winter specimens from the Nīlgiris have been assigned to the Himalayan form, *leucogaster.*

Plains, and as high as 5500′, where Terry found it at Pallangi. (In other districts as high as 8000′.)

Winter visitor, from September 21 to April 13. (September 18 to April 23 in Tanjore District.) In July and August I have found a few at the base of the Sirumalai and Alahar Hills, where it is probably resident.

Fairly common, wherever there are shady trees. I have heard a song of 6 or 8 notes, somewhat low-pitched and squeaky. The call is a low, grating, nasal note: *queenk.*

Hypothymis azurea styani. Black-naped Flycatcher. *I pidippōn.*

Western hills, from 1200′ to 4300′. (In other districts from the plains up to 5000′.)

My records fall between March 30 and June 22, but it is probably resident.

Uncommon, in thick undergrowth in forests. The song is clear but not loud, consisting of about 8 notes, of which the 7th is the highest and most emphatic. The call is a loud, excited, double squeak.

Leucocirca aureola. White-browed Flycatcher. *Visiri kuruvi.*

Specimens taken in S. Arcot and Travancore belong to the race *compressirostris.*

Palni Hills from 2700′ to 4200′. (In other districts up to 6000′.)

Probably resident.

Rare, on thinly-wooded slopes.

Leucocirca pectoralis. White-spotted Flycatcher.

Specimens from Salem District and the Nīlgiris belong to the typical form.

Terry called this far from common in the Putthūr valley on the north slope of the Palni Hills, but Mr. Whistler thinks this observation is unlikely to be correct. (Up to 6000′ in the Nīlgiris.)

Lanius vittatus. Bay-backed Shrike. *Kīchān kuruvi.*

Plains, and up to 1000′ on Nāha Malai. (In Mysore as high as 3300′.)

Resident.

Fairly common, especially among thorny bushes in dry open places. The grating, scolding note is not as loud as the Rufous-back's.

Lanius schach caniceps. Rufous-backed Shrike.

At all elevations.

Resident.

Common in open places, most numerous in cultivated areas on the plains and in the upper hills. Seen mating on February 12; young birds well grown on March 18.

Lanius cristatus. Brown Shrike.

The typical form has been taken in Salem District and in Travancore.

Plains, and as high as 7100′ in the hills.

Winter visitor, from August to April 23. (April 27 in other districts.)

Fairly common, especially during migration, when as many as 10 may be seen in a day. Perches conspicuously in open places. The harsh scolding notes are louder and more persistent than the Rufous-back's.

Hemipus picatus picatus. Pied Shrike.

Western hills from 2000′ up. (Down to 500′ in other districts.)

Resident.

Fairly common, in tree-tops in forest. As many as 6 in a flock.

Tephrodornis gularis sylvicola. Malabar Wood Shrike.

Western hills from 2400′ to 4500′. (In districts to the west, it occurs from the plains to 6000′.)

Resident.

Uncommon, in flocks of about 12, in thick trees. The call is of 2 whistled notes followed by a soft snarl on a lower pitch.

Tephrodornis pondiceriana pondiceriana. Small Wood Shrike.

Plains, and up to 1200′ in the hills. (Elsewhere up to 5000′.)

Resident.

Fairly common in leafy trees, singly or in small groups.

Pericrocotus flammeus. Orange Minivet. *Pot kuruvi, Māmbala kuruvi.*

Western hills, from the base to the summit. (Down to 200′ elevation in Travancore.)

Resident.

Common in the lower hills, fairly common at Kodaikānal, rare at the base. Flocks are found in tree-tops in forests.

Pericrocotus peregrinus. Small Minivet.

Salem District specimens are the typical *peregrinus*, but those from Travancore are *malabaricus.*

Plains, and up to 5000′ in the hills.

Resident.

Fairly common, in flocks of about 10, in tamarind and other leafy trees. In flight, they give a constant chorus of high, feeble whistles.

Lalage sykesi sykesi. Black-headed Cuckoo-Shrike.

Plains, and up to 4000′ in the Palni Hills. (7000′ in the Nīlgiris.)

Winter visitor, from October 24 to April 14.

Rare resident. (Arrives October 15 at Tambaram.)

Fairly common in shady trees. The call is a lazy, buzzing snarl.

Graucalus javensis. Large Cuckoo-Shrike.

Specimens of the subspecies *macei* have been taken in Salem District and in Travancore.

Plains, and up to 4000′ in the Palni Hills, the latter according to Fairbank.

Probably resident. In the hills my records are from Jan. to July, on the plains from November 12 to Feb 13. (Biddulph observed one on Rāmēswaram in October.)

Uncommon, in trees. I have heard a call somewhat like a paroquet's.

Artamus fuscus. Swallow-Shrike.

Plains, and at any elevation on the hills.

Resident.

Uncommon on the plains, fairly common between 4000′ and 6000′ in the Palni Hills. Flocks of about 12 perch on open branches and soar in the open.

Dicrurus macrocercus. Black Drongo. *Kari chān, Karuvāttu vāli.*

The subspecies *peninsularis* has been taken in Trichinopoly District, on Rāmēswaram, and in Travancore.

Plains, and open slopes up to 4000′ in the Putthūr valley according to Terry. (On the Nīlgiri plateau it is probably a winter wanderer.)

Resident on the plains.

Abundant on the plains, ranking 3rd in my records. Terry found it common on the slopes of the Palni Hills. Found in open country on conspicuous perches.

Dicrurus longicaudatus. Gray Drongo.

Plains, and hills as high as 7100′.

Winter visitor, from October 5 to March 30.

Uncommon, in mango groves, scrub jungle, and forests. The song, *ku-kwik. ku-ku, kwik,* is less varied than the other Drongos'.

Dicrurus coerulescens coerulescens. White-bellied Drongo.

Most records from the foot of the hills up to 4300′. (To 7000′ in other districts.)

Resident in the hills.

Uncommon, usually found in scrub jungle. The notes are sweeter than the Black's, but not as loud or pleasant as those of the Bronzed.

Chaptia aenea malayensis. Bronzed Drongo.

Western hills, from the base to 5000′.

Resident.

Fairly common, in moderately heavy forest and along roads.

Dissemurus paradiseus malabaricus. Racket-tailed Drongo. *Erutthu vālan, Kondai kari chān.*

Hills, between 2000′ and 4000′. (Up to 7000′ in the Nīlgiris.)

Resident.

Fairly common, but not as numerous as the Bronzed. Found in open spaces under the leafy roof of the forest. Some of the notes are squeaky, but others remind one of the Magpie-Robin or even the Shama.

Acrocephalus stentoreus brunnescens. Great Reed Warbler. *Kosu kattai, Nunni chirai.*

Plains, and up to 6100′ in the western hills.

Winter visitor, from September 24 to May 2. (Resident in Ceylon.)

Fairly common in bushes near water.

Acrocephalus dumetorum. Olive Reed Warbler.

Plains, and up to 7000′ at Kodaikānal.

Winter visitor, from August 27 to April 20, but Terry's Putthūr specimen was taken on June 26.

Fairly common, and more generally distributed than the preceding, in grain fields as well as near water. Though not as loud as the chattering calls of the Great Reed, the notes of the Olive Reed are more emphatic than the similar calls of the Tree Warbler.

Orthotomus sutorius. Tailor-bird. *Thaiyal chittu, Pon chittu.*

Specimens from Rāmēswaram and Salem District are placed in the Indian race, *guzurata*, but those from Travancore are closer to the Ceylon race, *sutorius*.

Plains, and up to 5500′ in the hills. (To 8000′ in Ceylon.)

Resident.

Common in scrub jungle and plantations on the hills. Found only in moist places on the plains.

Cisticola exilis erythrocephala. Red-headed Warbler. *Vayalān chittu.*

Upper Palni Hills above 5500′. (As low as 3500′ in Mysore.)

Resident.

Fairly common on grassy downs where there are few cattle, as around the Kodaikānal reservoir. The first syllable is a nasal note like the twanging of a taut rubber-band; this is followed by a sweet double whistle.

Cisticola juncidis salimalii. Streaked Warbler.

In the Wynaad and eastern plains, *cursitans* is the subspecies found.

Plains, and Sālim Ali obtained the Travancore form at Kumili, 3000′. It is possible that Terry also saw this species near Kodaikānal. (In other districts as high as 7000′.)

Resident.

Fairly common, almost always seen in rice fields.

Franklinia gracilis albogularis. Gray-breasted Warbler. *Kosu kattai, Nunni chirai.*

From 2700′ to 4800′ in the hills, and also one uncertain record on the plains near Dindigul. (From sea-level in Ceylon it ranges up to 5000′ in Travancore.)

Resident.

Uncommon, in tall grass or bushes near jungle. The song is a series of loud single chirp's.

Schoenicola platyura. Broad-tailed Warbler.

Western hills, from 3000′ at Kumili up to 6800′ at Kodaikānal.

Resident.

Rare, on steep bracken slopes.

Hippolais caligata. Tree Warbler.

A specimen of the typical form has been taken at Cape Comorin.

At all elevations.

Winter visitor, from September 3 to April 30.

Common, in trees and shrubbery, usually singly. I have heard a low-pitched, tuneless, chattering warble. The calls are a low *chack,* a chatter, and a throaty rattle.

Sylvia hortensis. Orphean Warbler.

The subspecies *jerdoni* has been taken at Bombay.

I have observed several well, in scrub jungle on the plains near Thēni, October 5 to March 22. This is the southern limit of its winter range.

Phylloscopus affinis. Yellow-bellied Warbler.

5500′ to 7100′ on the Palni Hills. (As low as 2800′ in Mysore.)

Winter visitor, November 16 to April 25.

Fairly common in some seasons, in trees. The call is a *chack* somewhat like a Tree Warbler's.

Phylloscopus trochiloides viridanus. Greenish Warbler.

The Green Warbler, *trochiloides,* has also been taken in Salem District and Travancore.

Plains and hills at all elevations.

Winter visitor, September 21 to May 20. (The Green Warbler has been collected in Travancore in July.)

Common in tree-tops, especially during migrations. The song is a loud, clear warble, 'willowy, willowy, willowy', up to about 16 notes.

Phylloscopus magnirostris. Large-billed Warbler.

Sālim Ali found it at Periyār Lake, 3000′. (In other districts, from 2000′ to 4000′.)

Winter visitor. (November 15 to March 7 in Travancore.)

Phylloscopus occipitalis occipitalis. Large Crowned Warbler.

Western hills, from 3000′ at Kumili up to 7000′ at Kodaikānal. (In Salem District it has been recorded also on the plains.)

Winter visitor, from February 28 to April 21. (Arrives November 19 in Mysore.)

Rare, in trees.

Prinia socialis socialis. Ashy Warbler.

Plains, and up to 7000′ in the hills.

Resident.

Fairly common in grain-fields on the plains, common on bracken slopes just below Kodaikānal.

Prinia sylvatica sylvatica. Jungle Warbler.

Plains, and up to 4700′ in the Palni Hills.
Resident.
Common in scrub jungle at the base of the hills, rare elsewhere. A loud triple note repeated several times, more emphatic than the similar double note of the Tailor-bird.

Prinia inornata franklinii. Indian Warbler.

Specimens of *inornata* have been taken in Trichinopoly District.
Plains, and up to the top of the hills.
Resident.
Very common in grain-fields on the plains, and also on bracken slopes on the Palni Hills. The song is rougher and more insect-like than that of the Ashy; is usually starts with a little click : *tlik*. . . .

Irena puella puella. Fairy Bluebird. *Pana kāra kuruvi.*

Western hills, from the base up to 4200′. (To 5000′ in other districts.)
Resident.
Uncommon, in tree-tops in thick forest. The notes are loud and clear. One bird repeated, 'chip her', over and over.

Oriolus oriolus kundoo. Golden Oriole. *Manjal koluppan.*

Plains, and up to 4400′ in the hills. (In other districts as high as 6000′.)
Winter visitor, from October 24 to April 13. (From September to June in Cochin State.)
Fairly common, in trees along roads or in gardens. The song is a clear, liquid rendering of the name 'oriole', but there are often 5 syllables and some harsh notes as well. A single grating note is the one most often heard in winter.

Oriolus xanthornus maderaspatensis. Black-headed Oriole.

Hills, from the base up to 5000′. (From sea-level at Madras it ranges up to 7000′ in the Nīlgiris.)
Resident.
Fairly common in heavy trees. A common call may be written *krark.*

Gracula religiosa indica. Grackle. *Naiyāndi kuruvi.*

2500′ to 5000′ in the hills. (Found also in the low country of Ceylon.)
Resident.
Common in tree-tops in plantations and light forest. In addition to the loud clear cries, there are conversational notes which sound like Donald Duck's voice in the talkies !

Pastor roseus. Rosy Starling. *Sūrai kuruvi, Chōlam batchi.*

Plains, and up to 3000′ at Kumili.
Winter visitor, from October 21 to April 12. (In other districts the species arrives in August and stays until May.)
Dense flocks contain up to 400 birds, and are found in open country and fruiting trees. Fairly common.

Sturnia malabarica malabarica and **S. m. blythii.** Gray-headed Myna.

Specimens of both subspecies were taken by Cook at Thēkadi.
Winter visitor to the plains from November 6 to March 10. (The Northern form stays until April 9 in Travancore.) Probably the Southern form, *blythii,* is resident at Periyār Lake.
Compact flocks are found in trees, like Starlings. Uncommon. In winter, the commonest call is a mild single whistle, a little tremulous.

Temenuchus pagodarum. Brahmany Myna. *Pāppātthi nāhanavāy.*

Plains, and occasionally on the High Wavy Mountains up to 5000′. (In the Nīlgiris the upper limit is 7000′.)

Resident.

Fairly common in the wetter portions of the plains, sometimes near houses. Flocks of up to 60 are sometimes seen with Rosy Starlings in winter. The song is soft and rambling, made up mostly of pleasant, warbling notes.

Acridotheres tristis tristis. Common Myna. *Nāhanavāy.*

Plains only. Fairbank thought that this species was common about villages in the Lower Palnis at 4000′, but I have found only Gray Mynas there on frequent visits. (In Coorg the Common Myna wanders up to 3750′ in company with Gray Mynas in winter.)

Resident.

Second only to the House Crow on the plains, about houses and in remote fields. Its falsetto laugh is a little sharper than the trill of the White-breasted King-fisher. The syllables *keedle* often recur in the song.

Aethiopsar fuscus. Gray Myna. *Kāttu nāhanavāy.*

The subspecies *mahrattensis* has been taken in Salem District and Travancore.

From 1000′ at the foot of the hills, up to 7600′ at Kodaikānal. In 1923 the species had not yet reached Kodaikānal but was found at Kavunji, 6400′. By 1931 it was found as high as there are houses at Kodaikānal. (In Travancore it occurs down to sea-level.)

Resident.

Fifth in abundance in my Kodaikānal list, and abundant also in the lower hills. It is a bird of villages and open places more than of jungle, and nests in buildings as much as the Common Myna does. The notes are rougher and less pleasant than those of the Common.

Ploceus philippinus philippinus. Weaver-bird. *Thūkkanan kuruvi, Thonganatthān.*

Plains only. (The Travancore form ascends the hills to 3000′.)

Resident.

Common in many places, usually nesting in colonies in coconut or thorn trees. When grain is ripe, flocks of weavers give employment to many small boys. Seen building nests from June 27 to September 19. Carrying flying termites to nests on October 7. The most distinctive of its notes is a long, wheezy whistle, as if the bird were drawing its breath in.

Munia malacca malacca. Black-headed Munia. *Thinai kuruvi.*

On the plains, at Dindigul and near the base of the Palni Hills; and as high as 7000′ in the upper Palni Hills.

Resident, probably mainly in the hills. My plains records are on March 23 and between July 27 and Nov. 28.

Uncommon on the plains, fairly common according to Terry on the lower slopes of the hills toward Palni, rare on the upper hills. In flocks in grain fields. The flight-call is a triple chirp; another note is a mild, plaintive, little *ink.*

Uroloncha striata striata. White-backed Munia.

From 1000′ in the rice fields at the base of the hills, up to 4700′. (From the plains to 6000′ in other districts.)

All my records fall between February 14 and November 20. Probably resident in the lower hills.

Fairly common, in flocks of as many as 40.

Uroloncha kelaarti jerdoni. Rufous-bellied Munia.

Plains, and up to 7000′ at Kodaikānal.

Probably resident. I have seen only three flocks on the plains, in June, December, and January. My records on the hills are in March, May, and June.

Uncommon, in flocks up to 20. Call: a high-pitched, nasal squeak.

Uroloncha malabarica. White-throated Munia.

Plains, and up to 6500′ at Kodaikānal.

Resident. Seen building nests on Feb. 13.

The commonest of the plains-munias, occurring in flocks of as many as 60 birds. More fond of dry fields than other munias. Its notes are a twittering cheeping, a plaintive little whistle, a sharp *chip*, and a triple chirp.

Uroloncha punctulata lineoventer. Spotted Munia.

Plains, and western hills as high as 6600′. (In the Nīlgiris it occurs up to 7000′.)

Resident. Seen carrying nest material from May 19 to August 27.

Fairly common, especially near water. The call is a brief, mild, rather husky whistle: *t'hee.*

Amandava amandava. Red Munia.

The typical form has been taken in Mysore.

5500′ to 6900′ in the Palni Hills. (As low as 2000′ in Mysore.)

My four records and Terry's one were all between April and June.

Rare. The largest flock contained 20 birds. I have heard a high-pitched, musical twittering, and a husky squeak.

Carpodacus erythrinus roseatus. Rose Finch.

3000′ to 8000′ on the western hills. (Also on the plains in other districts.)

Winter visitor, from February 1 to May 1. (Other districts, November 22 to May 2.)

Rare. I have heard a thin squeak gliding upward.

Gymnorhis xanthocollis xanthocollis. Yellow-throated Sparrow.

Plains, and up to 900′ on the Nāha Malai. (Ascends to 4500′ in other districts.)

Resident.

Fairly common, in trees in farming areas. Flocks of hundreds gather in ripening grain fields.

Passer domesticus. House Sparrow. *Ūr kuruvi, Adaikala kuruvi.*

Specimens from Trichinopoly District and Travancore are of the race *indicus.*

Plains. Fairbank recorded the species in villages up to 5000′, but I have not seen it above 1200′ in the hills. (Occurs at all elevations in the Nīlgiris.)

Resident.

Ranks fifth in abundance among the plains birds. Found about houses except when large flocks raid the grain-fields.

Riparia rupestris. Crag Martin. *Thahaivilān kuruvi, Ney kuruvi.*

Terry saw some at Putthūr, about 6000′ elevation in the Palni Hills. I have only one doubtful record. (As low as 2000′ in other districts.)

Perhaps a rare winter visitor.

Riparia concolor. Dusky Martin.

At Dindigul Rock, elevation 900′, on the Nāha Malai, and in the western hills up to 6850′. (At all elevations in Travancore.)

Resident.

Uncommon, in groups of about 12 birds. The call is a soft grating sound.

Hirundo rustica. Eastern Swallow.

Subspecies *gutturalis* has been taken in Travancore.

Plains, and hills up to 1150′ only. (In Mysore it occurs as high as 2900′.)

Winter visitor, from September 1 to April 19.

Common, flocks of thousands being seen on wires in October and April.

Hirundo javanica domicola. House Swallow.

3000′ to the top of the western hills. (As low as 2000′ in other districts.)

Resident.

Common, ranking 10th in order of abundance at Kodaikānal. Often nests on verandahs.

Hirundo smithii. Wire-tailed Swallow.

A specimen from the Nilgiris belongs to the race *filifera.*

Plains only. (In other districts it occurs up to 5000′.)

Winter visitor, December 20 to March 19.

Rare. I have seen it near Madura City, which seems to be the southernmost record of the species.

Hirundo daurica. Red-rumped Swallow.

The subspecies *erythropygia* has been taken in Trichinopoly District and Travancore.

Plains, and as high as 6000′ at Top Station. (In other districts as high as 8000′.)

Resident.

Uncommon, but sometimes as many as 60 in a flock, over towns or in wild places. I have heard a loud, low-pitched note like *cheer*, and a sparrow-like chirp, and a more nasal *queenk.*

Motacilla alba. White Wagtail. *Vannāthi kuruvi, Kulatthu kuruvi.*

The race *dukhunensis* has been obtained in Travancore.

Plains only, at Dindigul and Batlagundu. (Up to 5000′ in other districts.)

Winter visitor, December 1 to March 4. (Arrives in November in other districts.)

Rare, beside tanks.

Motacilla maderaspatensis. Pied Wagtail.

Plains, and up to 7500′ in the hills.

Resident.

Fairly common at tanks and ponds. When there is no water elsewhere, they enjoy even the iron water-tanks at railway stations. The clear whistled notes are sometimes run together rapidly in a brilliant song.

Motacilla cinerea. Gray Wagtail.

The race *caspica* has been taken in Salem District and Travancore.

All elevations.

Winter visitor, from August 27 to May 7. On the plains, it occurs chiefly during migrations. (In neighbouring districts, August 21 to May 22.)

Common on the hills.

Motacilla flava beema. Gray-headed Wagtail.

A local specimen seems to be *beema*, the Blue-headed, race. The Grey-headed, *thunbergi*, and the Short-tailed, *simillima*, have both been taken in Travancore.

Plains. (J. B. Primrose saw a flock of the Short-tailed at 5000′ in Travancore.)

Winter visitor, September 15 to April 26.

Abundant in wet fields. Flocks contain up to a thousand birds. I think most of them are Gray-headed. The notes are rougher than the clear, shrill whistles of the Gray Wagtail, and also a bit plaintive.

Motacilla citreola. Yellow-headed Wagtail.

Specimens of *M.c. werae* have been taken in North Kanara.

Plains, at Batlagundu, December 20. (Up to 2000′ in other districts.)

Rare winter visitor.

Dendronanthus indicus. Forest Wagtail.

3000′ at Kumili up to 7000′ at Kodaikānal. (As low as 200′ in Travancore and Cochin.)

Winter visitor. My only record is October 23. (Arrives September 19 in Mysore; departure date in Travancore is April 21.)

Rare.

Anthus hodgsoni hodgsoni. Indian Tree Pipit. *Pul kuruvi.*

5200′ to the top of the Palni Hills. (As low as 2000′ elsewhere.)

Winter visitor, October 25 to May 4. (Arrival date outside our district is September 19.)

Fairly common under thick trees into which it flies when alarmed.

Anthus nilghiriensis. Nilgiri Pipit.

4000′ to the top of the Palni Hills. (Down to 3000′ in Tinnevelly District.)

Probably resident.

Fairbank and Terry called it common and secured specimens, but I find it hard to identify. Found on the open downs.

Anthus similis. Rufous Pipit.

The typical form has been taken in Travancore.

6000′ to the top of the Palni Hills, according to Hume, but neither Fairbank nor Terry found it here. I have only 3 probable records, above 5500′. (In Travancore it occurs as low as 3500′.)

Probably resident.

Rare. In 1937, I called this species fairly common, but I now think most of the Kodaikānal birds are Indian Pipits.

Anthus richardi. Siberian Pipit.

Specimens of the typical form have been taken in Travancore.

Plains only. (Also in the hills in adjacent districts.)

Winter visitor, October 21 to April 12. (In other districts until May.)

I suspect it to be fairly common, but do not often dare to identify it unless native pipits are present for comparison.

Anthus rufulus malayensis. Indian Pipit.

Specimens were taken by Fairbank. The form found on the plains is more likely *rufulus*, specimens of which have been taken in Salem District and on Rāmēswaram.

Plains, and as high as 7000′ at Kodaikānal.

Resident.

Common in grassy meadows and open fields. The song is a series of 5 to 20 *clink's*, often given in flight. The call is a thin, high whitsle.

Anthus thermophilus. Daurian Pipit.

Plains only. (As high as 2500′ in Mysore.)

Winter visitor, from November 22 to March 27.

Uncommon, on the ground in fallow fields and waste places, in flocks of about 20.

Alauda gulgula. Sky Lark. *Vānambādi.*

Specimens of *australis* have been taken in Travancore, and of *gulgula* in Ceylon.

On the plains, it is found throughout the better-watered parts of the Vaihai and Kambam valleys. On the hills, it occurs on grassy hill-tops.

Resident.

Fairly common where found on the plains, common on the downs on the upper hills. The song has trills, long-drawn whistles, rapid staccato passages, metallic *clinks*, all in a continuous stream of sound lasting several minutes, during which the bird is fluttering slowly upward on a slant.

Calandrella brachydactyla. Short-toed Lark.

The subspecies *dukhunensis* has been taken on the Godavari delta.

Plains, near the Vaihai River. This is the southern limit, Fairly sure records extend from October 31 to March 8.

Uncommon. I have several times seen large compact flocks that were too shy to approach. I have heard a brief song of 6 or 8 *chip's,* slightly musical. The call is a single, soft, querulous note.

Mirafra javanica. Singing Bush Lark.

The race *cantillans* has been taken in Bhopal.

Plains, where I have one record near Viruppākshi, latitude 10° 28′. (Stuart Baker says the species occurs as far south as Travancore, but Whistler finds no definite records south of Mysore.)

Winter visitor, February 12.

Mirafra affinis ceylonensis. Madras Bush Lark. *Pul vānambādi.*

The specimen which Fairbank secured at Periyakulam belongs to the Ceylon race, but the birds of our eastern plains may be *affinis*, the eastern Madras form.

Plains. (In other districts as high as 5000′.)

Resident.

Common in open grassy fields. The song consists of about 12 thin notes on one pitch.

Galerida malabarica. Crested Lark. *Kondai vānambādi.*

5500′ to 7500′ on the Palni Hills. (As low as 2000′ in other districts.)

Resident.

Uncommon, on open downs.

Ammomanes phoenicura. Rufous-tailed Lark. *Vānambādi.*

The typical form has been taken in Trichinopoly and Coimbatore Districts.

Plains, and small hills up to 1100′. My southernmost record is at Kalluppatti near Tirumangalam. (Rāmēswaram is the only place where the species has been recorded farther south. As high as 2800′ in Mysore.)

Winter visitor, September 12 to April 19. (Biddulph's Rāmēswaram records cover the period from May to October, suggesting that our birds migrate eastward to the coast during the southwest monsoon. Resident in Mysore.)

Uncommon, found in dry, rocky places, often singly. I have heard a flight-song of about 10 syllables, a bit husky and low-pitched. The calls are a sweet, thrush-like *tee-hoo,* and a low, husky whistle, and a low chirp.

Eremopteryx grisea grisea. Ashy-crowned Lark. *Manal vānambādi.*

Plains, and up to 1200′ on rocky hillocks. (In Ceylon it occurs up to 7000′.)

Resident.

Common on the ground in dry places. A prolonged, mournful, clear whistle, together with a sweet little trill, make up the song, given while the bird soars and dips over a limited area.

Zosterops palpebrosa nilgiriensis. White-eye. *Kannādi kuruvi.*

Specimens of the race *salimalii* have been taken on the Shevaroys.

1200′ to the top of all the hills. (In Ceylon it occurs also in the low country.)

Resident.

Abundant on the upper hills, coming second only to the Red-whiskered Bulbul. Common on the lower hills. One flock at the foot of the hills in December. Found in flocks in trees and bushes. The song is a very light, fairy-like warble with a slight huskiness in it.

Cinnyris lotenia. Maroon-breasted Sunbird. *Pūn chittu, Thēn chittu.*

Plains. (Elsewhere the species occurs up to 5500′.)

Fairbank secured a specimen years ago at the foot of the Palni Hills on June 5, and I saw one at Dindigul on November 26.

Cinnyris asiatica asiatica. Purple Sunbird.

Plains, and as high as 5300′ in the hills. (To 8000′ in the Nilgiris.)

Resident.

Common around flowering trees and bushes.

Cinnyris minima. Small Sunbird.

2400′ to 7200′ on the western hills. (In Travancore the species descends to the foot of the hills.)

Resident in the lower hills. At Kodaikānal all my records come after May 13.

Fairly common. The call is a shrill chirp.

Cinnyris zeylonica. Purple-rumped Sunbird.

Plains, and into the hills as high as 7000′ at Kodaikānal.

Resident, at least on the plains.

Very common on the plains, fairly common on the lower hills, one record at Kodaikānal. I have noted as many as 60 in a day.

Arachnothera longirostra longirostra. Spider-hunter.

1300′ to 7000′ on the western hills. (On the west coast it is also found in the low country.)

Resident.

Uncommon, in undergrowth near the edge of forest. The call is a loud, shrill *cheep.*

Dicaeum concolor concolor. Plain Flower-pocker. *Pūn kotthi.*

On the plains, I have one record at Periyakulam, 3½ miles from the foot of the hills. It occurs at all elevations on the western hills.

Resident.

Very common, ranking 7th among Kodaikānal birds. Found in tree-tops, especially where there are parasitic plants. In addition to its familiar *check* calls, it sometimes gives a rapid series of *tick's.*

Dicaeum erythrorhynchos erythrorhynchos. Pink-billed Flower-pecker.

Plains, and Fairbank collected one on the side of the Palni Hills. I have seen a few at 6900′ at Kodaikānal.

Resident.

Fairly common in thick trees. I have heard it give a high-pitched series of notes like mouse-squeaks.

Piprisoma agile. Thick-billed Flower-pecker.

Specimens of the typical race have been taken on the Nilgiris and in Travancore.

Plains, and lower hills up to 4000′. (In other districts up to 7000′.)

Resident, but March 16 is my only plains record.

Rare.

Pitta brachyura. Pitta. *Āru mani kuruvi.*

Plains, and up to 5000′ in the hills. (To 7000′ on the Nilgiris.)

Winter visitor, from October 10 to April 10, but Mrs. Cantlay reports that one spent most of a hot season in her garden on the High Wavy Mountains.

Rare, on the ground near thick trees.

(*To be continued*)

NEW RECORDS OF FISH FROM POONA.

BY

M. SUTER, D.SC.

In the last April issue of the *Journal* (Vol. xliii, No. 1, pp. 79-91, 1942), Capt. A. G. L. Fraser, I.M.D., published the first part of his account of the fishes found in the waterways at Poona, and, besides a general account of the extensive collections made by him in 1936-1937, gave descriptions of localities with lists of fishes collected from each. Dr. S. L. Hora very kindly sent to me the type-scripts of the remaining two parts[1] of the series and suggested that I should supplement Fraser's list by making further collections of fishes from different localities at various seasons. I was further informed that special efforts should be made to collect small, bottom-dwelling forms from among the rocks. Although Fraser had collected representatives of 54 species, including *Bagarius bagarius* (Hamilton) which was collected but not sent to the Indian Museum for determination owing to the large size of the specimens obtained, the expectation of ample scope for further collecting was fully justified by the 17 new records of species from this area.

In the course of my collecting, the following localities were repeatedly visited:

1. The part of the Mutha river between Kadhakwasla Lake and the village of Wadgaon, forming a stretch of about 3 miles of rocky or gravelly runs alternating with pools of some size. The banks of the latter are partly loamy, partly rocky, the bottom being mostly hard and often bouldery. The right bank is covered with heavy bush and tree vegetation, partly orchards, whilst the left bank is more open. Some of the pools are fairly weedy along the banks.

2. The part of the Moola river between Fitzgerald bridge and the village Kharadi, about 4 miles further east; this being in the main a rocky and bouldery stretch, with several broad pools, shallow in the dry season and intersected by little rocky runs.

3. The stretch extending between a point 1 mile above the confluent of the Bhima and Moola rivers to Wadgaon village, some 5 miles east of the confluent, i.e., downriver. This region is a succession of large and partly deep pools, united by shallow runs and ending in the great pool of Wadgaon, over 2 miles long and 100-150 yards wide, after which the river runs through a rocky chasm or 'Khund' about a mile long. Through this the river runs with a terrific turmoil during the rains, but, at the time of my visit, this rocky part was so dry as to be unsuitable for collecting.

The banks on this stretch are high and much eroded by floods. They are partly composed of sandy loam, partly they are Deccan trap rock, and the bottom is sandy in parts, rocky or bouldery in others. The high banks are fairly densely covered with babul jungle, interspersed with such typical Deccan plants as *Capparis aphylla, Cassia auriculata, Cryptotegia grandiflora, Ficus glomerosus,* Nim and Tamarind, the latter forming shady groves, planted by the Forest Department.

The dry weather shoreline shows the usual mixture of Tamarisk, sedges, lillies and coarse grass. There is little aquatic vegetation, as this would be swept off annually by the floods.

4. A visit was paid to the Indrayani river at Kalumbre village, below the sacred pool of Dehu, a fish sanctuary teeming with large carp and mahaseer.

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[1] These have since been published in Vol. xliii, No 2 of the *Journal* (p. 218).

It may be stated at the very outset that no attempt at general collecting was made in the localities 1 and 2; this having already been done by Capt. Fraser. Attention was, however, focussed on the procuring of species not contained in his collection.

Locality No. 1 produced *Barilius gatensis* (Cuv. and Val.), new to Poona, *Barilius bendelisis* (Ham.) as well as *Glyptothorax madraspatanum* (Day) and *Osteochilus nashii* (Day). The latter two were mainly procured by dismantling, under a net, large heaps of stones or 'killas' laboriously built by the local Kolis. *Cirrhina reba* (Ham.) was also collected here, as well as *Garra gotyla* (Gray).

Locality No. 2 yielded the interesting novelty *Mystus bleekeri* (Day), numbers of *Glyptothorax madraspatanum* (Day) and a specimen of *Nemachilus evezardi* (Day), several examples of *Nemachilus anguilla* Annandale were also collected in this stretch, all being supplementary to the Fraser collection.

A general collection, yielding over 40 species, was made in the locality No. 3, as the large and deep pools were expected to provide an asylum for many species, which habitually retire from the vicinity of Poona, where rivers become very shallow after the rains. This assumption proved to be correct, in as much as the pools were found to be well stocked with large specimens of various Labeos, notably *Labeo kawrus* (Sykes), *Barbus jerdoni* (Day), *Silonopangasius childrenii* (Sykes), Murrels., *Proeutropiichthys taakree* (Sykes), *Rohtee vigorsii* (Sykes), *Bagarius bagarius* (Ham.), and plenty of various Chelas and Rohtees, all of which were caught in large numbers. Curiously enough, *Wallangonia attu* (Block) did not materialise, but is undoubtedly present.[1]

From the point of view of my collection, the locality yielded the following interesting species:

Garra bicornuta Rao, *Schismatorhynchus nukta* (Sykes), both very uncommon and curious fish; *Glyptothorax annandalei* Hora and *Mystus montanus* (Jerdon); all in rocky and bouldery situations where there was a flow.

The pools contributed *Aspidoparia morar* (Ham.), *Labeo ariza* (Ham.), *Labeo kawrus* (Day) and *Laubuca laubuca* (Ham.) as additional novelties. *Mystacoleucus ogilbii* (Sykes) occurs in numbers.

Mystus montanus frequents rocky places, where it is said to reach enormous size. The local Kolis have traditions of epic fights between such giants and the local croc, here called 'soosir', which they relate with great gusto. The local opinion attributes the cause of these contests to competition for the possession of underwater caves, of which both these monsters are said to be fond.

The pools are richly stocked with *Rita hastata* (Val.), *Rita pavimentata* (Val.) and large *Mystus aor* (Ham.); but this season few Mahaseer were caught, all of the stocky and high backed type, now classified by Dr. Hora as a separate species, *Barbus* (*Tor*) *mussullah* (Sykes.).

The gravelly runs yielded specimens of the two *Barilius* already procured at Poona and large numbers of *Nemachilichthys ruppelli* (Sykes) and *Nemachilus anguilla* Annandale.

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[1] It has since been collected. (M.S.)

By far the most common Barbels of the region are *Barbus kolus* Sykes, which is abundant, and *Barbus* (*Puntius*) *ticto* Hamilton.

The locality No. 3 proved so productive that it would probably be well worth further investigation.

Locality No. 4 was visited for the special purpose of procuring a large specimen of the stocky and high-backed Mahaseer. As a result of my collecting, the following 77 species are now added to the list of 54 species obtained by Fraser:—

LIST OF SPECIES SUPPLEMENTING CAPT. FRASER'S COLLECTION

SCIENTIFIC NAMES	MARATHI NAMES	LOCALITY	FURTHER DISTRIBUTION
Order: EVENTOGNATHI			
Family: CYPRINIDAE			
Subfamily: *Abramadinae*			
***Laubuca laubuca** (Hamilton)	...	Nagergaon, Bhima river.	North India and Malaya.
Subfamily: *Rasborinae*			
Barilius bendelisis (Hamilton) ...	Jodhie	Mutha, Moola and Bhima.	Ganges and South India.
***Barilius gatensis** (Cuv. and Val.) ...	Jodhie	Nander, Mutha river. Pargaon, Bhima river.	Western Ghats, Nilgherry Hills.
***Aspidoparia morar** (Hamilton) ...	Gor Amblee	Nagergaon, Bhima river.	North India.
Subfamily: *Cyprininae*			
***Barbus (Tor) mussullah** (Sykes) ...	Mussulah	Kalumbre, Indrayani river. Pargaon, Bhima river.	Mysore and Nilgiris.
Cirrhina reba (Hamilton)	Lolee	Mutha, Moola and Bhima rivers.	India and Ceylon.
Labeo kawrus (Sykes)	Kawrus	Pargaon, Bhima river.	Deccan.

Labeo ariza (Hamilton)	Kawrus	Pargaon, Bhima river.	Deccan.
***Osteochilus nashii** (Day)	Bershee	Nander, Mutha river. Nagergaon, Bhima river.	Coorg, Nilgherries.
***Garra gotyla** (Gray)	Mullya	Nander, Mutha river.	Hymalayan region, Satpuras, Vindhyas.
***Garra bicornuta** (Rao)	Nukta mullya	Nagergaon, Bhima river. Wadgaon, Bhima river.	Mysore.
Family : COBITIDAE			
Nemachilus anguilla (Annandale) ...	Mow	Pargaon, Bhima river. Mutha and Moola, Poona.	Western Ghats.
Nemachilus evezardi (Day)	Moree	Moola river, Poona.	Western Ghats and the Satpuras.
Order: NEMATOGNATHII			
Family : BAGRIDAE			
***Mystus montanus** (Jerd.)	Kohira	Wadgaon, Bhima.	Coorg, Wynad, Mysore, Travancore.
***Mystus bleekeri** (Day)	Kala seenghal	Moola river, Poona.	Burma.
Family : SISORIDAE			
Glyptothorax madraspatanam (Day) ...	Kengra	Mutha and Moola, Poona.	South India.
Glyptothorax annandalei (Hora.) ...	Pivla kengra	Wadgaon, Bhima.	Bhavani river.

By far the most common Barbels of the region are *Barbus kolus* Sykes, which is abundant, and *Barbus* (*Puntius*) *ticto* Hamilton.

The locality No. 3 proved so productive that it would probably be well worth further investigation.

Locality No. 4 was visited for the special purpose of procuring a large specimen of the stocky and high-backed Mahaseer. As a result of my collecting, the following 77 species are now added to the list of 54 species obtained by Fraser:—

LIST OF SPECIES SUPPLEMENTING CAPT. FRASER'S COLLECTION

Scientific Names	Marathi Names	Locality	Further Distribution
Order: EVENTOGNATHI			
Family: Cyprinidae			
Subfamily: *Abramadinae*			
***Laubuca laubuca** (Hamilton)	...	Nagergaon, Bhima river.	North India and Malaya.
Subfamily: *Rasborinae*			
Barilius bendelisis (Hamilton)	Jodhie	Mutha, Moola and Bhima.	Ganges and South India.
***Barilius gatensis** (Cuv. and Val.)	Jodhie	Nander, Mutha river. Pargaon, Bhima river.	Western Ghats, Nilgherry Hills.
***Aspidoparia morar** (Hamilton)	Gor Amblee	Nagergaon, Bhima river.	North India.
Subfamily: *Cyprininae*			
***Barbus (Tor) mussullah** (Sykes)	Mussulah	Kalumbre, Indrayani river. Pargaon, Bhima river.	Mysore and Nilgiris.
Cirrhina reba (Hamilton)	Lolee	Mutha, Moola and Bhima rivers.	India and Ceylon.
Labeo kawrus (Sykes)	Kawrus	Pargaon, Bhima river.	Deccan.
Labeo ariza (Hamilton)	Kawrus	Pargaon, Bhima river.	Deccan.
***Osteochilus nashii** (Day)	Bershee	Nander, Mutha river. Nagergaon, Bhima river.	Coorg, Nilgherries.
***Garra gotyla** (Gray)	Mullya	Nander, Mutha river. Nagergaon, Bhima river.	Hymalayan region, Satpuras, Vindhyas.
***Garra bicornuta** (Rao)	Nukta mullya	Wadgaon, Bhima river.	Mysore.
Family: Cobitidae			
Nemachilus anguilla (Annandale)	Mow	Pargaon, Bhima river. Mutha and Moola, Poona.	Western Ghats.
Nemachilus evezardi (Day)	Moree	Moola river, Poona.	Western Ghats and the Satpuras.
Order: NEMATOGNATHII			
Family: Bagridae			
***Mystus montanus** (Jerd.)	Kohira	Wadgaon, Bhima.	Coorg, Wynad, Mysore, Travancore.
***Mystus bleekeri** (Day)	Kala seenghal	Moola river, Poona.	Burma.
Family: Sisoridae			
Glyptothorax madraspatanam (Day)	Kengra	Mutha and Moola, Poora.	South India.
Glyptothorax annandalei (Hora.)	Pivla kengra	Wadgaon, Bhima.	Bhavani river.

The material was very kindly examined by Dr. Hora thus permitting the compilation of the list of species supplementing those contained in Capt. Fraser's collection.

Species marked with an asterisk (*) are novelties, not having been previously recorded from the Poona region; the others, though not obtained by Fraser, are already known to occur in these waters.

I am aware that this number does not cover the entire fish fauna of Poona, which may yield further surprises, quite apart from being known to embrace various species not yet collected by Capt. Fraser or by myself. I allude, amongst others, to such species as *Barilius evezardi* Day, *Rasbora rasbora* (Ham.), *Barbus parrah* Day, *Nemachilus moreh* (Sykes) and other previous records.

SIGNIFICANCE OF NEW FINDS.

My attention was drawn by Dr. Hora to the zoo-geographical significance of some of the species collected, especially of the novelties now recorded for the Poona region, which enable a hydrographic link to be established with some far distant regions.

Alluding to such species as *Osteochilus nashii* (Day), *Barilius gatensis* (Cuv. & Val), *Garra bicornuta* Rao, *Glyptothorax annandalei* Hora, *Mystus montanus* (Jerdon), Dr. Hora pointed out;

> 'Your collections have brought to light an organic palaeo-hydrographic connection between the faunas of the Bombay section of the Ghats and its southern portion. From a zoo-geographical point of view it is of very great interest indeed and supports the views I have been recently expressing regarding the origin of the fauna of Peninsular India.'

Commenting on the distribution of certain species collected by Capt. Fraser, Dr. Hora and Mr. Misra remarked:

> 'The occurrence of *Schizmatorhynchus* Bleeker and *Mystacoleucus* Günther is of special significance; besides in the Western Ghats, the former is found only in the Malay Archipelago, while the latter is found in Burma, Siam, Malaya, etc., but nowhere else in India. These two genera show the Malayan affinities of the fauna of this part of the Western Ghats. *Labeo boggut* (Sykes) has also been recorded from the Malaya, but this requires further confirmation.'

The extended distribution of *Laubuca laubuca* (Ham.) and *Mystus bleekeri* (Day) gives further support to these views.

It is intended to continue collections and eventually to draw within their scope the headwaters of some of the local rivers in the Ghat region, where interesting material might be expected.

Remarks to Dr. Fraser's articles on Fishes of Poona.

The following comments and addenda to these articles may be of some interest:

Part 1. *Fish of Lake Fife.* The secret of catching mahaseer in this lake is to drag a 2-3 inch spoon through a shoal of fish, as they chase chilwas on the surface. They do this most often on a calm day before noon and after 4 p.m. Mere blind trolling is not conducive to results, besides being extremely boring.

I have caught mahaseer upto 12 lbs in this lake and seen larger ones. Catches of netting by fishermen I inspected consisted of the following: *Barbus (Tor) khudree, Barbus dobsoni-jerdoni, Rohtee vigorsii, Wallagonia attu, Chela phulo* and *Chela boopis, Labeo boggut* and *Cirrhina reba.* Murrel are also present.

Floating aquatic plants in the Mutha-Moola river.

Water cabbage (*Pistia stratiotes*) and water hyacinth (*Potenderia crassipes*) sometimes form compact meadows above dams and rocky places, or in quiet bays, but get swept away by the first monsoon flood.

Number of species in the region.

I agree with Dr. Fraser that the number of 143 species, said to be recognised by local fishermen, is highly exaggerated. These men often have separate designations for juveniles and adults, and make other arbitrary distinctions.

The total number of species is probably well under 100.

Part III.

Chela. Judging by many catches of professional netters during a period of 8 years, *Chela phulo* is the most abundant species and is often caught by many hundredweights. This is never the case with *Chela clupeoides.*

After a violent thunderstorm these fish swim about in dense shoals on the surface in a semi dazed condition, together with other fish, when very large catches are made by netters. The fish are very distressed and are finally washed ashore in a dying condition in many hundreds. On such occasions I have found amongst the defuncts quite large specimens of *B. kolus, B. dobsoni-jerdoni,* B. *sarana* and *Wallagona attu* as well as various labeos.

Danio aequipinnatus, Rasbora daniconius and *Barbus ticto* are numerous in pools of the Mutha river 5 miles below the lake. Here *Barbus ticto* is generally pale golden yellow with bright red fins, and often a bright pink gloss over the body.

Garra mullya is indeed a very common bottom fish, but the designation *Nukta mullya* does not correctly apply to it, but to *Garra bicornuta* and sometimes is used also for *Garra gotyla.*

Schismatorhynchus nukta (Sykes). The Indian name would be more correctly spelled *Dotondee* i.e. 'two-mouthed' from 'tond'= mouth.

This remarkable fish is indeed not common. It frequents by preference very bouldery spots with some current, where they are very difficult to net. Its maximum weight appears to be about 3 lbs. Old males can be very gaily coloured, every scale having a bright pale pink gloss and an apple green margin. Some of the scales may have a bright red centre. The tips of the snout and of the nose are bright vermilion and the inside of the 'Schisma' is also bright red. The upper parts of the head are dark purple and the sides of the head have zones of lemon yellow and apple green, with a golden gloss on the gill covers, a remarkably gaudy combination.

Cobitidae. Most of these appear to dig themselves into fine gravel with the greater part of their bodies, and are there often caught in large numbers by the 'locals' who pronounce their taste as excellent, but complain about their intestines being often full of sand.

Silonopangasius childrenii (Sykes). These fish retire with various others after the monsoon floods into large pools 30-40 miles below Poona, where I have seen specimens weighing upto 15 lbs. They will occasionally take a spoon.

Xenentodon cancila (Ham.) I have observed these in lake Fife. The commonest name for this fish is 'Kutta'.

Ambassis ranga. Is very common below Fitzgerald bridge when the river is in flood. The pools of the Mutha river hold this fish at any time in fair numbers.

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Most of the success in practical collecting is due to my shikaree Haribhao Koli, whose expert knowledge of the habits and habitat of the local fish is considerable, and whose help in securing the willing co-operation of local fishermen was invaluable.

THE EARLY STAGES OF INDIAN *LEPIDOPTERA.*

BY

D. G. SEVASTOPULO, F.R.E.S.

PART XII.

(Continued from page 87 of this Volume)

RHOPALOCERA

PAPILIONIDAE

Graphium doson Fldr., *eleius* Fruhs.

Davidson & Aitken, *Journ. Bomb. Nat. Hist. Soc.*, v, 364, pl. E, figs. 2, 2a. 1890.
Moore, *Lep. Ind.*, v, 1 and 4, pl. 467, figs. 1, 1a, pl. 468. figs. 1, 1a. 1903.
Bingham, *Fauna Brit. Ind.*, Butterflies, ii, 107. 1907.
Jordan, *Seitz Indo-Austr. Rhop.*, ix, 96. 1909.
Talbot, *Fauna Brit. Ind.*, Butterflies, i, (2nd edit.), 222, pl. 1, figs. 20, 21. 1939.

Half-grown larva—Head honey colour. Body a velvety nigger brown, rather darker at the beginning of the instar and paler at the end. A sublateral white stripe from 6th to anal somite, where the stripes on each side are joined by a wide transverse band. Thoracic somites each with a black, short-branched, subdorsal spine. 12th somite with a white, short-branched, subdorsal spine, but closer together than the thoracic series. Legs nigger brown. Prolegs and anal claspers white. Venter pale nigger brown from 1st to 6th somite and whitish thereafter. Shape with the thoracic somites much swollen, the 3rd largest, and then tapering towards the tail.

Penultimate instar—The spines on the 2nd and 3rd somites unbranched, otherwise similar to previous instar. The colour often a pale bronzy green.

Full-grown larva—Head pale bluish green, slightly retractile. Colour leaf green, a sublateral white stripe from 6th somite backwards, but not joined by a transverse bar across the anal somite. Legs, prolegs and venter pale bluish green. A distinct sublateral fringe of short, white bristles. Spiracles whitish edged by a fine black line. Shape similar to previous instars, but the spines on the 1st and 2nd somites absent and that on the 3rd reduced to a raised black dot in the centre of a black-ringed, yellow spot. 1st somite with a transverse black line across the osmeterium pouch, which is slightly angled subdorsally. Osmeterium pale bluish green and only extruded reluctantly. Some larvae are a distinct bronzy green, in which case the tubercles on the thorax and anal somite seem slightly larger.

Pupa suspended by a girdle and tail pad of white silk. Shape head truncate, with a very short conical projection in front of each eye. Thorax with the keel developed into a forward-pointing horn, extending frontally to above the front edge of the head. A slight projection at the origin of the wing cases. Body fairly wide across the wing cases and then tapered to the cremaster. Colour pale watery green. A dark purplish median line from the posterior edge of the head to the apex of the thoracic horn. A raised yellow line from the tip of the thoracic horn along the upper edge of the wing case and then continued to the cremaster as a sublateral line. A slightly curved, whitish, subdorsal line from the cremaster to the origin of the thoracic horn, where the two lines join, this line edged above with dark green which gives it the appearance of being raised. The cuticle very coarsely and deeply punctate, the punctures above the sublateral lines filled in with dark green and forming faint, oblique, dark stripes between the sublateral and subdorsal lines, the punctures on the dorsum also filled in with dark green but not forming stripes. A pupa found wild under the coping of a white-washed wall, had the ground colour a greenish-grey, the subdorsal and sublateral lines brownish purple, the oblique lateral stripes brownish purple, an indistinct brownish purple dorsal line and brownish purple specks on the head, thorax and wing cases.

Food-plant—*Polyalthia longifolia* Wall, and *Michelia champaca* L. Talbot gives *Cinnamomum, Polyalthia* and other Anonaceae.

Described from a number of larvae found in Calcutta in October 1942, one of which pupated 13-x-42 and a female emerged 24-x-42.

The first of the two references of Moore is for the Southern Indian and Ceylonese race, then known as *jason* L., the second is for the race *axion* Fldr. from Kumaon to Burma. Jordan's description applies to the species generally, and is as follows:—'Larva black or green, the spines of the mesonotum absent and those of the third pair reduced to tubercles. Pupa varies in colour according to its environment; angles of the head distinctly projecting, thoracic horn bent forwards, gradually pointed, the tip itself rounded, the carinae of the horn sharp and straight.' The same description by Davidson & Aitken is quoted under *eleius* by Talbot and under *jason* by Bingham, this is as follows:—'larva very like that of *G. agamemnon* L., but the second pair of spines is entirely wanting and the third pair, which in *agamemnon* is rather long, curved and sharp, is reduced in this species to mere knobs encircled with a black ring. The colour is generally black or smoky until the last moult and then dull green, inclining to rusty brown on the sides, but some of our specimens remained quite black till the end. Pupa—the distinguishing mark of the pupa is again in the frontal horn, which is straight as in *agamemnon*, but directed forward instead of being almost erect. Its colour is normally green, but varies with that of the object to which it is attached.' Bingham adds, under *axion*, that the larva and pupa are very similar to those of *jason*, but that Moore figures the larva with a red lateral spot on the 3rd segment. Talbot's figures are not very life-like. My pupae were formed on leaves and on the dark, rusty sides of a large tin, but, in spite of the remarks quoted above, all were pale green.

LYCAENIDAE.

Chilades laius Cr., *laius*.

Moore, *Cat. Lep. E. I. Co.*, i, 21, pl. 12, fig. 1a. 1857.
Bingham, *Fauna Brit. Ind.*, Butterflies, ii, 366. 1907.

Pupa of the usual Lycaenid shape, short, head and anal end obtuse, the thorax and abdomen rounded with a slight depression between the two. Formed on a leaf of the food-plant on a mat of white silk and supported by a girdle. Colour bright leaf green, a dark dorsal line on the abdomen, pro-thorax with a median black streak, a black dot in the centre of the meso-thorax and another lateral dot above the edge of the wing case, a lateral black dot on the meta-thorax and 1st abdominal somite above the edge of the wing case. Spiracles white.

Described from a pupa found in Calcutta 12-x-42, from which a female emerged 18-x-42.

Bingham, quoting a description by de Niceville, writes:—'Pupa green; of the usual Lycaenid shape, with a dorsal and lateral series of somewhat obscure conjoined brownish spots on the upper-side. Attached to the underside of the leaves of its food-plant in the usual manner.' My specimen was attached to the upper surface of an orange leaf.

HETEROCERA

ARCTIIDAE.

Asota caricae Bsd. (*alciphron* Cr.).

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 402. 1938.
Gardner, *Indian Forest Records*, vi, 295. 1941.

Although the pupa of this species is usually formed in a slight cocoon on, or just below, the surface of the soil, in October 1942 in Calcutta I found a number of pupae in slight cocoons in spun-together leaves of the food-plant; in several instances these spun-up leaves contained two pupae in the one cocoon.

My original description of this pupa is somewhat brief, a fuller one is as follows. Pupa dark reddish brown, very shiny. Noctuid in shape. The cremaster consisting of a transverse row of four very short spines, with a second row of four spines, considerably further apart, behind the first row. These spines barely visible without a lens.

LYMANTRIIDAE.

Lymantria nigra Moore.

Gardner, *Indian Forest Records*, iii, 194, pl. iv, figs. 32, 33. 1938.

Head dull black, marked with dull greyish brown on the vertex on each side of the median suture, and in the middle of, and on the lower edge of, each cheek; the clypeus containing a dull pink line. Body brownish grey, a double black dorsal line from the 5th to anal somite, and an oblique black subdorsal line on each somite from 4th to 12th. 2nd and 3rd somites each with a velvety black, transverse dorsal fold, edged behind with very short crimson bristles mixed with longer black ones. 1st somite with a pair of blue-grey dorsal warts armed with black bristles and a subdorsal tubercle tufted with long, blue-black, simple hairs, a fringe of pale buff hair projecting over the head. 2nd and 3rd somites with a transverse series of four dorsal blue-grey warts armed with black bristles immediately behind the dorsal fold. 4th to 11th somites each with a dorsal pair of small blue-grey warts, a larger subdorsal wart posterior to the dorsal pair and a lateral wart, all armed with black bristles. A lateral and sublateral series of brownish grey tubercles tufted with longish plumose and simple pale brown hair. 12th somite with a backward pointing fringe of pale brown hair. A pale diamond-shaped dorsal mark extending from the posterior half of somite 7 to the anterior portion of 9. Dorsal glands black. Spiracles greyish brown ringed with black. Legs pale greyish brown. Venter and prolegs brownish grey tinged with greenish. Under a lens the ground colour is seen to be marbled with darker and paler.

Pupa in a few netted threads of brown silk. Dark reddish brown, the wing cases darker. Head, thorax and the dorsum of the abdomen thickly clothed with curly buff hair, intermixed on the head, pro- and meso-thorax with red-brown. Wing cases bare. A subdorsal, lateral and ventro-lateral series of tufts of short whitish hair on the abdominal somites. Thoracic spiracle set in a large black spot. Cremaster a stout spine terminating in a cluster of golden-brown, hooked bristles.

Food-plant Mango (*Mangifera indica* Linn.).

Described from a full-fed larva found in Calcutta 11-xi-42, pupated 14-xi-42, and a female emerged 21-xi-42.

Porthesia xanthorrhoea Koll.

Gardner, *Indian Forest Records*, iii, 205. 1938.

Head black, the clypeus outlined with white and with a transverse white bar above the mouth parts. 1st to 3rd somites deep yellow. 1st somite with a double longitudinal black dorsal streak, a subdorsal black tubercle tufted with longish black hair, and a subdorsal black band. 2nd and 3rd somites with a black dorsal line, a subdorsal series of short transverse black streaks, and a transverse series of six warts tufted with short black and grey hair, the two centre and the outer warts yellow, the others grey. 4th somite black, with two orange subdorsal spots, slightly humped—the hump surmounted by a double tuft of short black hair, a black subdorsal wart tufted with black hair. 5th somite similar, but without the orange subdorsal spots and the hump and wart giving rise to palmate white scales instead of black hair. 6th to 10th somites orange with a black dorsal line and indistinct black subdorsal stripe, a subdorsal and lateral series of black warts armed with palmate white scales and a few black hairs. 11th somite similar, but with a broad black band across the dorsum and the warts without white scales. 12th somite orange with a black dorsal line and subdorsal spot, a transverse fringe of long black hairs. A sublateral series of scarlet warts from the 2nd to 11th somite, with a fringe of outward pointing grey hair. Dorsal glands red. Legs black banded with whitish. Prolegs yellowish. Venter yellowish with a blackish median stripe.

Pupa in a cocoon of orange-brown silk mixed with larval hairs. Colour yellowish brown, the thorax somewhat darker and with a diffuse subdorsal stripe from 4th to 9th somite. 4th to 7th somites with a double subdorsal series of swollen blotches. Spiracles black.

Food-plant—*Lagerstroemia indica* L. in captivity.

Described from a full-fed larva found in Calcutta 20-x-42, spun 24-x-42, and a female emerged 1-xi-42.

Euproctis lunata Wlk.

Forsayeth, *Trans. Ent. Soc.*, pl. 14, figs. 5a-c. 1884.
Hamps., *Fauna Brit. Ind.*, Moths, i, 473. 1892.
Gardner, *Indian Forest Records*, iii, 206. 1938.

Head brownish olive, marked with white above the mouth parts. Body blackish. A broad white dorsal stripe with a black median line, interrupted between the somites, from the 6th to 11th somite, an interrupted pinkish lateral and whitish sublateral line, the latter much broader on the 10th and 11th somites. A transverse white dorsal band on the 12th somite. 1st somite with a dark red subdorsal tubercle tufted with grey hair and a dorsal fringe of grey hair projecting over the head. 2nd and 3rd somites with a transverse dorsal series of four greyish warts tufted with forward-pointing grey hair. 4th and 5th somites slightly humped dorsally and with paired dorsal tufts of short black hair, a broad white subdorsal stripe on these somites only. 6th somite with a double dorsal tuft of white hair. 6th to 10th somites with a subdorsal series and 4th to 11th with a lateral series of small black warts bearing very minute orange spines and longish blackish hairs. A sublateral series of reddish pink warts tufted with grey hairs forming a fringe from 1st to 11th somite. 11th somite with a small dorsal tuft of white hair. 12th somite with a transverse fringe of grey hair. A few minute white spines scattered throughout the white dorsal stripe. Dorsal glands white. Legs pink. Prolegs and venter pinkish grey.

Pupa in a cocoon of brown silk mixed with larval hair and spun in a leaf. Olive brown, the abdomen tinged with blackish except for a dorsal stripe on the 3rd to 7th abdominal somites. Clothed with short brownish hairs except on the wing cases.

Food-plant—*Carissa carandas* L. Gardner gives *Terminalia tomentosa* W. & A. and *Cinnamomum camphora* F. Nees.

Described from a full-fed larva found in Calcutta 16-x-42, spun 18-x-42, and a female emerged 29-x-42.

Hampson's description is 'larva brown, with anterior, posterior, and lateral tufts of long hair; thoracic somites with dorsal quadrate white marks; the third somite with paired dorsal tubercles; fifth to anal somites with paired dorsal quadrate white marks. Spins a hairy cocoon on twigs.' Gardner's description deals mainly with structure.

SPHINGIDAE.

Acherontia lachesis F.

Moore, *Lep. Ceyl.*, ii, 6, pl. 77, figs. 1b, 1c. 1882-83.
Hamps., *Fauna Brit. Ind.*, Moths, i, 68. 1892.

Mell, *Biol. u. System. der Sudchin. Sphing.*, 10, pl. xxi, fig. 1, pl. xv, figs. 1, 2. 1922.

Seitz, *Seitz Indo-Austr. Bombyces*, x, 526. 1928.

Bell & Scott, *Fauna Brit. Ind.*, Moths, v, 56, pl. i, figs. 1, 2, pl. vii, fig. 8, pl. xiii, fig. 1. 1937.

Head green with a broad black lateral stripe. Body yellowish green, venter and subspiracular area bluer. 4th to 10th somites with oblique lateral stripes, composed of an upper violet stripe shading into blue above and a lower cream stripe shading into yellow beneath the posterior stripe continued faintly to base of horn. Dorsum from 4th to 10th somites dotted with dark blue along the middle of the secondary divisions. Legs black. Prolegs same as venter. Spiracles black. Horn fairly thick basally, tapering to a point, downcurved slightly with the end curved strongly upwards and forwards, studded with large tubercles, colour yellowish green shading into yellow at the tip. The thoracic somites with the secondary rings forming dorsal ridges, most pronounced on the 2nd somite.

There are also brown and yellow forms of the larva but I have not met with them in Calcutta.

Pupa in a hollowed out subterranean cell, the walls apparently secured by pressure as there is no trace of silk. Dark mahogany brown, the wing cases and venter slightly paler. Proboscis sheath short and with prominent transverse ridges. Spiracles on the 8th to 10th somites with a ridged patch immediately in front of them. Meta-thorax with a pair of dorsal, pear-shaped, sunken patches surrounded by a raised ring. Cremaster black, the dorsal surface with large raised warts, terminating in two inwardly curving spines.

Both the larva and pupa make a squeaking noise.

Food-plant—Bell & Scott give the following:—*Erythrina* spp., *Jasminum* spp., *Nyctanthes arbor-tristis* L., *Ipomaea* spp., *Solanum* spp., *Datura*, *Nicotiana Tabacum* L., *Tecoma grandiflora* Loisel., *Stereospermum*, *Spathodea campanulata* Beauv., *Lantana Camara* L., *Stachytarpheta indica* Vahl., *Tectona grandis* L., *Vitex Negundo* L., *Clerodendron* spp., *Callicarpa arborea* Roxb., *Coleus*, *Colebrookia oppositifolia* Sm., *Anisomeles ovata* Br., *Antidesma*.

Described from a full-fed larva found in Calcutta 18-ix-42, buried 20-ix-42, and a female emerged 11-x-42.

Moore's figure is much too blue-green in colour. Seitz' description is 'adult larva green, yellow or brown, with thick white oblique stripes bordered with blue, not being contiguous, however, on the mesodorsum'. Hampson states that the 'larva differs from *styx* in having blue streaks above the yellow ones'.

Deilephila nerii L.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 407, 1938.

Yellow form—Head and ground colour of body mustard yellow. The ring of the ocellus on the 3rd somite deep purple shading into paler, instead of dark blue, the blue stripe below the pale lateral line very bright. A slight fuscous suffusion above the lateral line and rather more noticeable suffused fuscous patches below. Legs bright magenta. Prolegs and venter distinctly suffused with fuscous. The white spots on the lateral and dorsal area ringed with olive instead of dark blue.

Two larvae out of a batch of some thirty-five bred from ova in darkness and in very crowded conditions in Calcutta in November 1942. This form is evidently very rare and is possibly produced by unsatisfactory conditions, as these were the only two bred out of several hundred larvae reared during the last eighteen years.

Bell & Scott write :—'In another form of larva the ground-colour of head and body ochreous, with fuscous-grey oblique lateral patches on segments 6 to 12; ocellus darker than in the green form and ringed with black; true legs black. There are also forms with intermediate colouring.'

The larvae of this species were extremely common in Calcutta in November 1942 and a few were found which had the legs blue and the usual green colour replaced on the abdominal somites, with the exception of a narrow stripe above the lateral line, a ring round the spiracles, the venter, and claspers and flap, by pale blue grey.

Bell & Scott describe the typical larva as having the 1st somite soiled green, the 2nd, 3rd, 12th and 13th bright yellow and the rest of the body bluish green suffused with glaucous except on the venter, but all my previous larvae have had the green colour almost uniform all over.

Hippotion boerhaviae F.

Hamps., *Fauna Brit. Ind.*, Moths, i, 86, fig. 50. 1892.

Hamps., *Ill. Het.*, ix, 56, pl. 175, fig. 1. 1893.

Mell, *Biol. u. System. der Sudchin. Sphing.*, 281, pl. ix, figs. 19, 20, pl. xix, figs. 1, 2. 1922.

Seitz, *Seitz Indo-Austr. Bombyces*, x, 564. 1929.

Bell & Scott, *Fauna Brit. Ind.*, Moths, v, 425, pl. v, figs. 9, 10, 11, 12. 1937.

Head dark olive brown. Body dark olive brown, streaked minutely with darker except on the 1st to 4th somite. A black dorsal line from 1st somite to base of horn. A diffused pinkish buff subdorsal stripe, almost obsolete from the posterior part of the 3rd somite to the posterior edge of the 10th, then stronger and less diffused to the base of the horn and thence to the end of the anal flap. A very diffused pinkish buff sublateral stripe from 1st to 11th somite. 4th somite with a large subdorsal ocellus, almost straight above and very convex below, consisting of a black pupil shading into chestnut brown above and with a few white dots on the upper part, the whole surrounded by a creamy line, broader above and narrower below, and then by a black ring. 5th to 10th somites each with an oval subdorsal ocellus, the lower edge more convex than the upper, consisting of a purple brown spot with a transverse horizontal buff bar, ringed with black. A darker patch immediately above each ocellus, the edges diffused and shading into the general ground colour. 5th to 10th somites each with a pale buff subdorsal dot on the posterior portion just above the level of the ocelli. Horn straight and pointing backwards, short, thin, pale greyish buff, the tip cream. Legs pinkish. Venter and prolegs slightly paler olive brown than the dorsum and sprinkled sparsely with white dots. Spiracles whitish. The thoracic somites slightly tapered.

Pupa in a slight cocoon spun among litter. Pinkish bone colour, speckled from dorsum down to the spiracles with olive brown. A diffused olive brown dorsal stripe on the abdominal somites. Mesothorax with a diffused olive brown subdorsal spot. Venter speckled with black, the speckling more concentrated on the ventro-lateral area and forming a broad stripe. Spiracles black and set in small black spots. Leg and wing cases rather pinker than the rest of the body, the wing cases with a stripe composed of black specks along the costal edge and extending on to the leg sheaths, and with rows of black dots along the veins, a diffused greyish black stripe along the outer margin. Tongue case projecting slightly ventrally and rather more frontally. Cremaster a long, stout, black spine with tip minutely bifid.

Food-plant—*Boerhaavia repens* L. Bell & Scott give, in addition, *Impatiens balsamina* L., *Knoxia mollis* W. & Arn., *Spermacoce* spp. *Glossostigma spathulatum* Arn., *Boerhaavia diffusa* L. My specimens refused cultivated *Impatiens*.

Described from a full-fed larva found in Calcutta 21-x-42, pupated 26-x-42, and a female emerged 8-xi-42.

The references to previous descriptions of the early stages are not easy to follow. Hampson, in the Illustrations of Heterocera, gives a recognisable figure under the name of *theylia* L., but also figures under the name of *rafflesii* Btlr. the same larva as is figured by Bell & Scott in their fig. 9, but which they suggest is a different species. It is not *rafflesii*, whose larva is also figured by Hampson, but under the name of *vinacea* Hamps. The food-plants of both *theylia* and *rafflesii* are given as Rubiaceae of several species. In the Fauna, Hampson repeats the descriptions given in the Illustrations, but groups them all as forms of *theylia*. Seitz gives a very incomplete description and mentions *Morinda umbellata* (Rubiaceae) as food-plant. Bell & Scott give a rather washy figure of the usual brown form and the resulting pupa, and also a figure of the so-called black form, which Hampson, as mentioned above, figures as *rafflesii*, with its pupa; they suggest that, in spite of the apparent similarity of the imago, it is really another species in view of the larval and pupal differences, but no description is given. In the description of the brown form, they mention that all the ocelli have a crescent of pale blue above the upper edge and that there is a round blue supra-spiracular spot on segments 6 to 11. My specimens did not exhibit these. The pupa is described as 'livid bone colour'.

NOCTUIDAE.

Sideridis yu Guen. (*exempta* Wlk.)

Head olive brown. Body olive brown, with an underlying orange tint, minutely speckled with darker. A diffused orange subspiracular stripe, edged above from 1st to 6th somite with white, starting as a broad line on the 1st somite and gradually narrowing until it disappears on the 6th. A double subdorsal series of white specks from the 2nd to 11th somite, on the 2nd and 3rd somites these specks in a transverse line, from the 3rd to 10th with an anterior inner and a posterior outer pair, on the 11th somite with the anterior and posterior pairs in line with each other. 12th somite with one subdorsal speck. A supra-spiracular and spiracular series of similar specks. All these specks giving rise to a single, very short, black bristle. Spiracles black. A dark purple-brown spot just above the base of the 2nd and 3rd pairs of legs. Legs greenish tinged with brown. Venter and prolegs similar to the dorsum but slightly paler. Shape stoutish.

The larva is quite different to that of any other *Sideridis* or *Leucania* that I have seen or read of, as there are not even traces of longitudinal stripes.

Pupa subterranean in an earthen cell. Bright orange chestnut with traces of a darker dorsal stripe. A dark, dentate, transverse, dorsal ridge on the anterior edge of somites 7 to 10. Apex of abdomen blackish, rugose, with a few short spines. Cremaster a stout spine with bifid tip.

Food-plant—Grasses.

Described from a full fed larva found in Calcutta 18-x-42, buried 25-x-42, and a male emerged 5-xi-42.

Ilattia octo Guen.

Gardner, *Indian Forest Records,* vi, 274. 1941.

Head green, with a few minute black specks. Body green, a very fine, irregular, double, whitish, dorsal line, a similar subdorsal line and another similar line just above a narrow whitish lateral stripe. Legs green. Venter and prolegs green, the first two pairs obsolete. A few fairly long single black hairs. Shape long and slender. Becomes tinged with purple before pupation.

Pupa subterranean in an earthen cocoon. Slender. Colour olive brown, the thorax and wing cases more tinged with olive, a dark dorsal stripe on the abdominal somites, the intersegmental rings darker. Cremaster a double spine.

Food-plant—*Amaranthus* sp. Gardner gives *Chenopodium album* L., so would possibly eat other members of the families Amarantaceae and Chenopodiaceae.

Described from a full-fed larva found in Calcutta 22-x-42, buried 23-x-42, and a female emerged 31-x-42.

Gardner, after giving the structural characteristics of the genus, gives the following description :—'Head and body green, sometimes with a darker line above the spiracular level along the body; legs pale; spiracles pale with a fine dark rim. The granules on the head not as sharply defined as in *natalis*. Length about 23 mm.'

Symitha nolalella Wlk.

Head yellowish green. Body pale green with traces of a dark dorsal line. A double dorsal, a subdorsal, a double lateral, and a sublateral series of whitish specks giving rise to single, longish, white hairs. A pale spiracular line between the two lateral series of specks. Legs and prolegs pale green.

The larvae live semi-gregariously on young shoots of the food-plant, which they cover with a slight silken web.

Pupa in a canoe-shaped cocoon of pure white silk, the top flattened and surrounded by an erect fringe of short, coarse threads. Pale green, an olive-brown dorsal stripe from head to cremaster, the intersegmental rings also olive tinged. Later the ground colour turns to whitish and the dark markings become chestnut. Apex of abdomen blunt, with three dark chitinous teeth laterally. Spiracles chestnut. Cuticle coarsely punctate.

Food-plant—*Lagerstroemia Flos-reginae* Retz. and *L. indica* L.

Described from a full-fed larva found in Calcutta 4-x-42, spun 6-x-42, and a male emerged 12-x-42.

Polydesma umbricola Bsd.

Head dark brown with a pale, inverted, wide-armed, V-shaped mark. Body mottled with dark and pale brown, the colour actually consisting of dots and streaks on a creamy ground. The pale areas distributed as follows:—a dorsal stripe on the first three somites; a dorsal blotch on the posterior portion of the 4th somite; a dorsal stripe, somewhat irregular in outline, from the posterior half of the 5th to the anterior half of the 7th somite; a similar dorsal stripe from the posterior half of the 8th somite backwards; and the subdorsal and lateral areas of the 8th and 9th somites. A blackish dorsal V-shaped mark on the forepart of the 4th somite, and the pale dorsal stripe on the forepart of the 5th somite with a blackish line on either side. A double blackish spiracular line, below which the colour is slightly paler. 11th and 12th somites with very small, black, paired, dorsal tubercles. Legs pale brown with wide rings of dark. Venter and prolegs greenish, the first pair reduced slightly. Spiracles black. A few short colourless hairs arising from dark specks. Rests with the fore part of the body slightly humped.

Pupa in a thin cocoon of tough, rather papery, white, silk, spun in an angle of the box in captivity and covered with a leaf; in nature possibly in a chink in the bark of the tree on which it has fed. Pale chestnut, so thickly covered with white bloom that the colour is obscured. Shape slender. Cremaster a small bunch of hooked spines.

Food-plant—*Albizzia stipulata* Boiv.

Described from a full-fed larva found in Calcutta 15-x-42, spun 18-x-42, and a male emerged 1-xi-42.

Fodina pallula Guen.

Head pale green. Body pale green. A whitish dotted dorsal line, a whitish subdorsal line and a double whitish dotted lateral line. 1st to 5th and 11th somites each with a black dorsal dot on the anterior portion, the 1st somite with an additional black dot below the origin of the subdorsal line. Spiracles whitish with a brown speck at the lower end. A few short black hairs. Legs and prolegs very pale green. Anal claspers rather long. The dorsal and lateral dotted lines fade when completely full fed, and the larva turns purple before pupation.

Pupa subterranean in a slight earthen cocoon. Dark purplish brown, the ventral area of the abdomen slightly paler. Thorax and abdomen rather coarsely punctate. Cremaster two down curved spines.

Described from a full-fed larva found in Calcutta 18-ix-42, buried 21-ix-42, and a female emerged 2-x-42.

PYRALIDAE.

Glyphodes unionalis Hbn.

Head yellow green. Body jade green, a dark dorsal and a white spiracular line. 2nd somite with a minute black subdorsal speck. A few colourless hairs. Legs and prolegs colourless, glassy. Lives in a silk-lined, folded leaf. As in most green Pyralid larvae, it is probable that the skin is unpigmented, the colour being due to the blood, fat and contents of the intestines shewing through.

Pupa in a slight cocoon between leaves. Olive brown, the wing cases and venter greenish. A distinct raised dorsal keel on the anterior abdominal somites. Cremaster a stout spike armed with minute hooked spines.

Food-plant—Jasmine.

Described from a full-fed larva found in Calcutta 20-ix-42, pupated 21-ix-42, and a male emerged 27-ix-42.

Glyphodes vertumnalis Guen.

Head yellow, mouth-parts black. Body blue-green, a white spiracular line, below which the body is yellower. The blue tint chiefly due to the contents of the intestines. 1st somite with a black dorsal plate with a median pale green line. 2nd and 3rd somites each with one anterior and two posterior raised black dorsal spots with a subdorsal spot between them and a larger spot external to the subdorsal, two spots immediately above the spiracular line. 4th to 11th somites each with two pairs of black dorsal spots, a lateral and sublateral, also a ventro-lateral spot situated at the base of the prolegs on somites 6 to 9. 12th somite with a large round black dorsal spot, a lateral and a sublateral. Anal plate edged with black and with a black streak across the base. Legs whitish ringed with black basally. Venter and prolegs yellowish. All the black spots raised. Except for the black spots the skin is unpigmented, the blood and fat are yellow, and the blue-green colour of the living larva is due to the contents of the intestines. Lives in a silk-lined, folded leaf. Turns yellow before pupation.

Pupa in a slight cocoon either in chinks of bark or under the coping of a wall near the food-tree. Chestnut brown, paler on the venter. Leg and proboscis sheaths projecting slightly beyond the wing cases. Head produced into a slightly upturned snout. Cremaster a stout spike terminating in a few hooked spines.

Food-plant—*Tabernaemontana coronaria.*

Described from a full-fed larva found in Calcutta 15-ix-42, pupated 17-ix-42 and a male emerged 25-ix-42.

(To be continued)

SOME WHALE SHARKS AND SUN FISHES CAPTURED OFF CEYLON.

BY

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F.C.P., F.L.S., F.Z.S.

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(*With one plate and two text-figures*)

The present article briefly describes some captures of whale sharks and sun fishes of the family Molidae from the vicinity of Ceylon.

The earliest record of what is probably the whale shark is by Baldeus a Dutchman who had travelled extensively in the East. In his book of travels (1671) he states that the waters around Ceylon abound in various fishes and among the forms mentioned are 'Galleon-fishes, Sharks, Orados', etc. The first named might well be the Whale Shark, *Rhineodon typus* Smith, which has recently attracted considerable attention (Gudger 1934, and Prater 1941).

Rhineodon typus Smith

On 16th January 1942 the local press described the capture of a large spotted shark 'about 25 feet long and weighing nearly two tons' from off Kalutara on the west coast of Ceylon. Some days later a collector of the Colombo Museum who was sent out to investigate returned with the following information:—

The shark, a male, was captured at about 150 yards from the shore in a seine net at 11 a.m. on 15th January 1942. The animal was noosed and towed to the estuary of the Kalu ganga and thence down the lagoon to Katukurunda by fifty men. The head was as large as that of an 'elephant' with a mouth resembling the slit in a 'letter box', the jaws were toothless. The intestines contained quantities of minute shrimps (probably Euphausiids) massed into boli. The depth of the sea at the site of capture is about 2 fathoms. No shark of this species was known from Kalutara before, but the writer saw a specimen about 15 feet long by the road side near Beruvala about 8 miles south of Kalutara, in December 1930. The dried pectoral and caudal fins of the Kalutara specimen were obtained on the 30th of January. They were bluish brown with white spots; the pectorals were more strongly spotted than the caudal and white below. A pectoral fin measured 3 feet 5 inches along the outer edge and was 2 feet 1 inch wide across its base. There were 13 spots along the longest part of the fin, 11 spots along its broadest part (pl. I, *b*). The caudal fin was 5 feet 3 inches along its upper lobe, 2 feet 7½ inches along its lower lobe, the tips of the lobes were 5 feet apart. Its spots were fewer and less prominent than on the pectorals, the most conspicuous being 18 in a row along the upper lobe and lateral to the vertebral column (pl. *I. a*).

Comparison of these measurements with those given by Prater (1941) suggests that the specimen was about 24 feet long.

The body ridges of Rhineodon and its pigmentation of white spots on a slate background are somewhat reminiscent of the oceanic leathery turtle *Dermochelys coriacea* (Linné) while the arrangement of the white pigment into alternate transverse bands and rows of spots occurs on such oceanic Pisces as tunnies and certain sail and spear fishes which are never taken in shore seines.

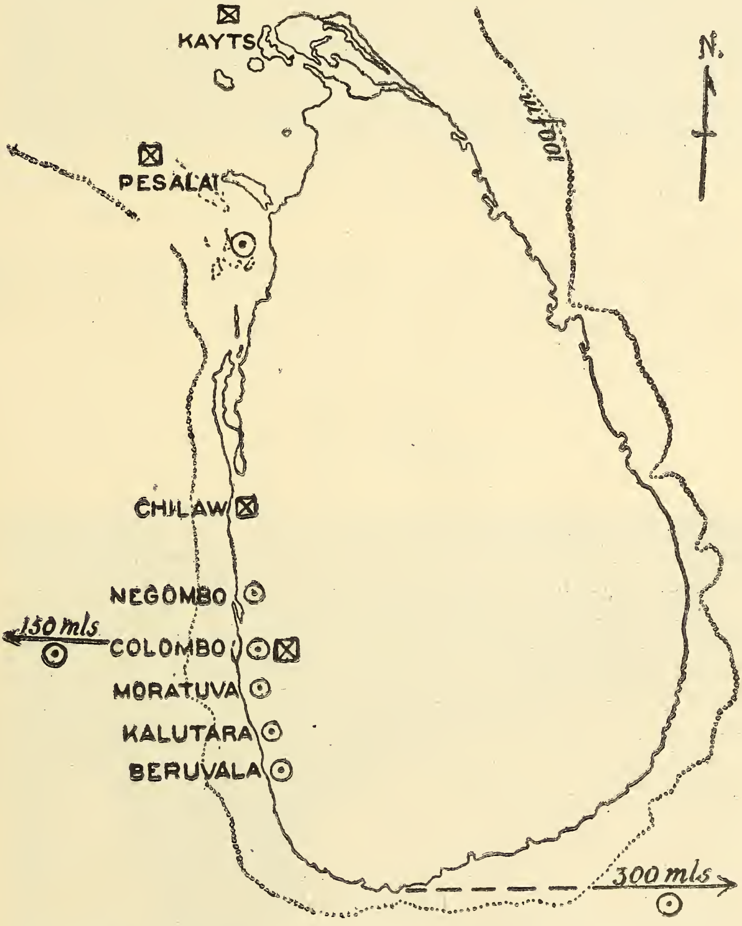


Fig. 1.—Map of Ceylon showing the 300 metre isobath and the stations off which Rhineodon (circles) and the Molidae (squares) have been captured.

The entry of whale sharks into shallow water and the fact that specimens have been rammed by vessels at considerable distances from Ceylon are of interest. With two exceptions the various individuals noted from Ceylon (Prater 1941) were taken in water under 20 feet deep. The locality where a 40-foot specimen was rammed by the Japanese ship 'Katori Maru' en route to Singapore was described by Captain Matsukura in the daily press (*Daily News*, August 6, 1935) as follows :—'We left Colombo on the afternoon of July 9th at 2.30 p.m.; the following day I was having my siesta in my cabin. We were about 300 miles out in the Indian Ocean. Suddenly I heard a noise which seemed to come from below.' . . . 'Presently I discovered it was a large fish, about 40 feet long, and with a big gash just behind its head.' . . . 'From the symmetrical shape of the tail and the sharp fins we could tell that it was not a whale but a tiger shark. Also the fish was turned on its side and I saw the gills'. Doubtless the captain termed the fish a tiger shark owing to its markings. The other such occurrence was on November 23, 1932, when the Dutch ship 'Johan van Oldebarnevelt' struck a whale shark in lat. 7°.5′ N., long. 77°.51′ E., about 150 miles west of Colombo (Gudger 1937). A study of the steam ship routes shows that both occurrences are approximately between 6° and 7° N. latitude. The first collision would be in water over 2000 fathoms deep, the second in water between 1000 and 2000 fathoms deep.

All whale sharks from the coastal waters of Ceylon were captured or noted between January and March. Those from the deeper waters off Ceylon were noted in July and November.

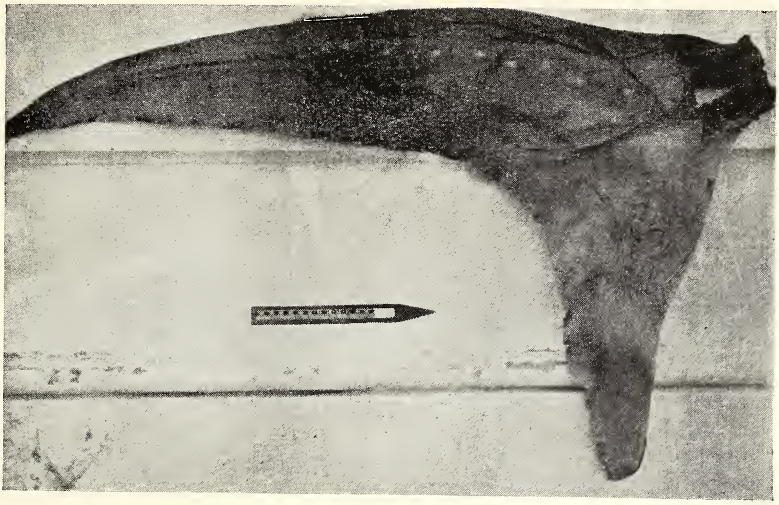
The list is as follows—January—3 sharks.
February—2 do.
July—1 do.
November—1 do.
December—1 do. (Beruvala).

Although the whale shark exceeds 50 feet in length individuals over 22 feet are rarely taken from the coastal waters of either India or Ceylon.

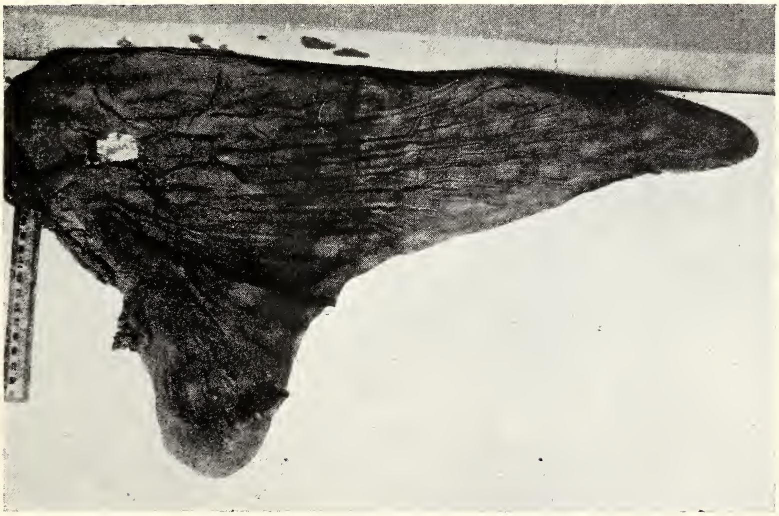
The ramming of two individuals in July and November at 300 miles to the east, and 150 miles to the west of Ceylon respectively, suggests that the shark is not uncommon in the deeper waters of the tropical Indian Ocean. The fact that one of these specimens was 40 feet long suggests that generally only adolescents about 20 feet long venture close to land. These are probably attracted by the unusually rich supply of plankton resulting from the monsoon rains.

Family MOLIDAE.

This family comprises three monotypic genera; of these the genera *Ranzania* Nardo 1840 and *Mola* Cuvier 1798 are known from Ceylon waters and have been captured in February, May, and June. The number of individuals known from Ceylon is five; three of these are



A. A caudal fin of Whale Shark taken at Kalutara, Ceylon.



B. Pectoral fin of Whale Shark taken at Kalutara, Ceylon.

Ranzania, one is *Mola*, the fifth which was taken off Colombo in 1885, was unidentified.

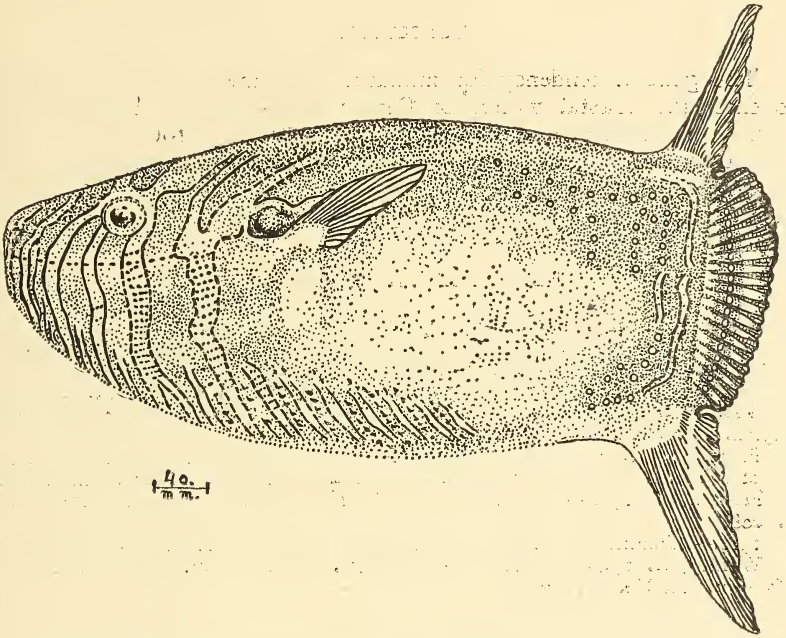


Fig. 2. *Ranzania laevis* captured off Pesalai, north west Ceylon in 1941, Drawn by P. Deraniyagala from a photograph and cast.

Ranzania laevis (Pennant.)

Whitley (1933) has shown that this is the correct name for the truncate sunfish. If this species is to be subdivided into subspecies the 'forma typica' is the Atlantic fish, and the Indian Ocean form is *Ranzania laevis varius* (Shaw).

In 1798 Pennant described a specimen from Ceylon as *Balistes truncatus* in the *Outlines of the Globe*, vol. i, p. 213. On May 10, 1910, a specimen (66.04 cm.) 26 inches long, (33.02 cm.) 13 in. deep was captured in Kayts harbour, north Ceylon (Pearson 1911) and on February 6, 1941, another 580 mm. long, 320 mm. deep, with a head length of 230 mm. distance from tip of dorsal to tip of anal fin 550 mm., was captured off Pesalai, north west Ceylon (fig. 2). It was photographed by the Colombo Museum and a cast obtained.

Mola mola (Linné.)

The specimen in the Colombo Museum was taken off Chilaw to the north west of Ceylon in June 1914 (Pearson 1914). Its dimensions are as follows :—

Standard length 740 mm., depth 550 mm., head length 210 mm., distance from tip of dorsal to tip of anal fin 1270 mm. As this fish is known to attain to a length of eight feet and a weight of 1200 pounds, the Ceylon specimen is an immature individual.

CONCLUSION.

The general tendency for immature specimens of oceanic fishes to enter the coastal waters of Ceylon needs further investigation. If they are transported from common spawning grounds as newly hatched young, as in the case of the eel *Anguilla bicolor,* this line of enquiry is likely to yield results of value regarding the movements of the nektic fauna of the Indian Ocean.

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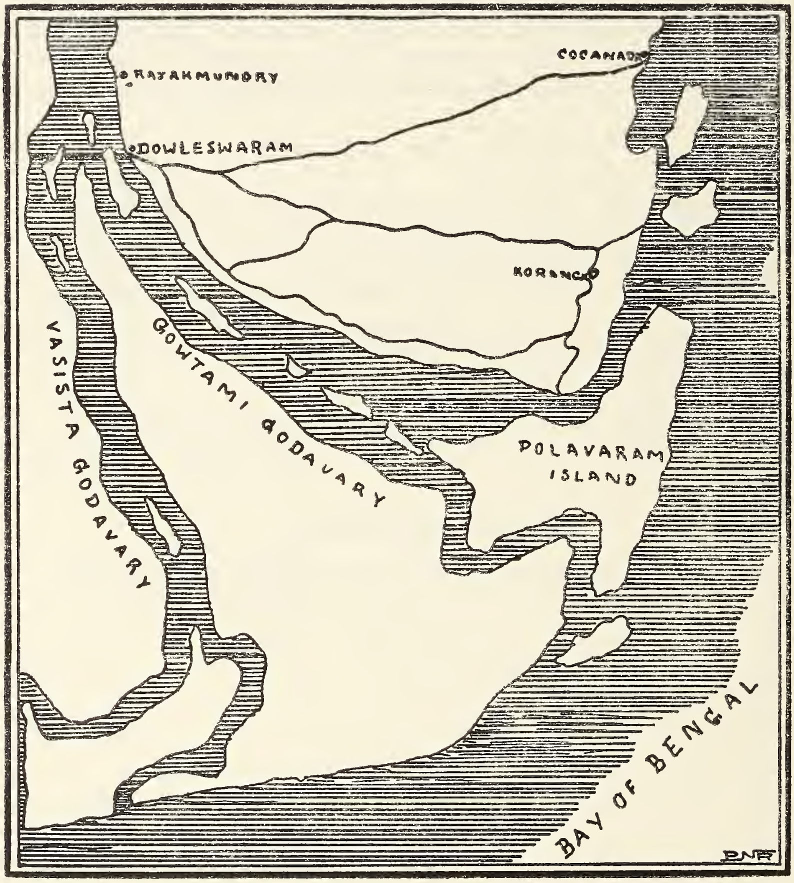
EXPLANATION OF PLATE.

Plate I—Fins of *Rhineodon typus* Smith from Kalutara.
a. Caudal, *b*. Pectoral.


RAJAHMUNDRY
DOWLESWARAM
COCANADA
KORANGI
VASISTA GODAVARY
GOWTAMI GODAVARY
POLAVARAM ISLAND
BAY OF BENGAL
BNF

Venkateshwarlu—Map of the Lower Godavary.

THE ESTUARIAL FLORA OF THE GODAVARY.

BY

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(*With a map and two plates*).

INTRODUCTION.

Hooker (5) remarks: 'The four chief estuarial floras of India occupy the deltas of the *Ganges, Irrawady, Mahanady* and *Indus;* but minor ones, notably those of the *Kistna* and *Cauvery,* occur at intervals commonly along the eastern shores, more rarely on the Western.' The estuarial flora of the *Godavary,* which Hooker, however, omits to mention, consists of a number of mangroves with an undergrowth of perennial woody climbers, followed by the halophytes on the exposed mud-flats towards the landside.

The Lower *Godavary* branches into the *Vasista Godavary* and the *Gowtamy Godavary,* and the mangrove forests are the gifts of the latter (Cornwall, 2). These forests are situated on muddy flats formed owing to the silting activity of the *Gowtamy Godavary* for over a century and more, before it reaches the sea at *Coringa*, once called the *Coringa Bay.* (Plate I).

There is a sort of zonal distribution among the species of the mangrove forest. The pioneer species are *Avicennia alba* and *A. marina* which pave the way for the species of *Rhizophora, Bruguiera, Ceriops, Sonneratia,* etc. The species of *Lumnitzera, Aegiceras* and *Excoecaria* prefer shallower waters towards landside. Finally, the bare and the much-exposed regions are occupied by the halophytic *Chenopodiaceae.* The undergrowth of plants is made up of the spinous *Dalbergia,* the prickly *Caesalpinia* and the twiners, *Derris* and *Sarcolobus.* The network of the canals is lined by *Acanthus ilicifolius* and the tall grass *Myriostachya Wightiana* (Plates II & III).

As quite a number of details regarding many of the mangroves have been long ago given by the late Fr. Blatter (1) repetition will be avoided in the following description.

SYSTEMATIC ACCOUNT.

In the following list of twenty-six plants which have been arranged in their respective families I have as far as possible given their vernacular names, and have also added a few notes on their economic importance, even though these plants are mainly valuable to people of the localities as fuel.

I. RHIZOPHORACEAE.

1. **Rhizophora mucronata** Lamk., F.B.I., ii, 435.

Syn: *R. Candelaria* W. & A.
Vern. Names: Uppa-Ponna (Tel.); Kandal (Tam.).
Habit: A glabrous evergreen tree of the swamps buttressed by long stilt roots, forming more or less the outermost fringe of the vegetation towards the sea.

Uses: The bark is brown, with vertical clefts, and is used as a valuable tanning material; wood is hard and is an excellent fuel.

2. **Ceriops Roxburghiana** Arn., F.B.I., ii, 436.

Vern. Names: Gatharu (Tel.); Chiru Kandal (Tam.); Goran (Hind.).
Habit: A small evergreen tree with many buttresses at base and rounded scaly reddish pneumatophores.
Uses: The bark yields a good red-orange dye which is used for colouring the fishing nets of the local villagers to make them last long; the wood also serves as a good fuel.

3. **Bruguiera conjugata** Merr.

Syn: *B. gymnorhiza* Lam., F.B.I., ii, 437.
Vern. Names: Thuddu ponna (Tel.); Kankra (Hind).
Habit: A rather large evergreen tree with a short stout rugose radicle and kneed pneumatophores.
Uses: Wood red, extremely hard, used for building and fuel. The radicles form an article of diet for the local villagers.

4. **Bruguiera cylindrica** W. & A.,

Syns: *B. caryophylloides* Bl.,
B. malabarica Arn., F.B.I., ii, 438.
Vern. Name: Vurudu (Tel.).
Habit: A small tree of the tidal forests.
Use: Wood useful as fuel.

II. VERBENACEAE.

5. **Avicennia officinalis** Linn., F.B.I., iv, 604.
Vern. Names: Nalla Mada (Tel.); Upatha (Tam.); Orei (Mal.).
Habit: A small tree with leaves obtuse at apex, elliptic-oblong or obovate, attenuate at base; anthers exerted; capsule ovoid.

6. **Avicennia alba** Bc.

Syn: *A. officinalis* var. *alba.*, C. B. Clarke., F.B.I., iv, 604.
Vern. Names: Vilava Mada, Gundu Mada (according to Gamble J. S.) (Tel.).
Habit: A shrub with leaves lanceolate, very acute or acuminate; capsule when young conical and beaked, when old ovoid.

7. **Avicennia marina** Vierh.

Vern. Names: Mada (Tel.); Venkandan (Tam.).
Habit: A large shrub with leaves acute at apex, anthers included, capsule ovoid.

The various species and varieties of *Avicennia* form the bulk of the mangrove forests here and make up the principal source of the supply of fuel in these regions. The flowers of *A. officinalis* are chewed along with betel leaves by the local people.

8. **Clerodendron inerme** Gaertn., F.B.I., iv, 589.

Vern. Names: *Pisung* (Tel.); Pinchil, Sangam (Tam.); Batraj (Hind.).
Habit: A straggling shrub occurring among the plants of the tidal forests.

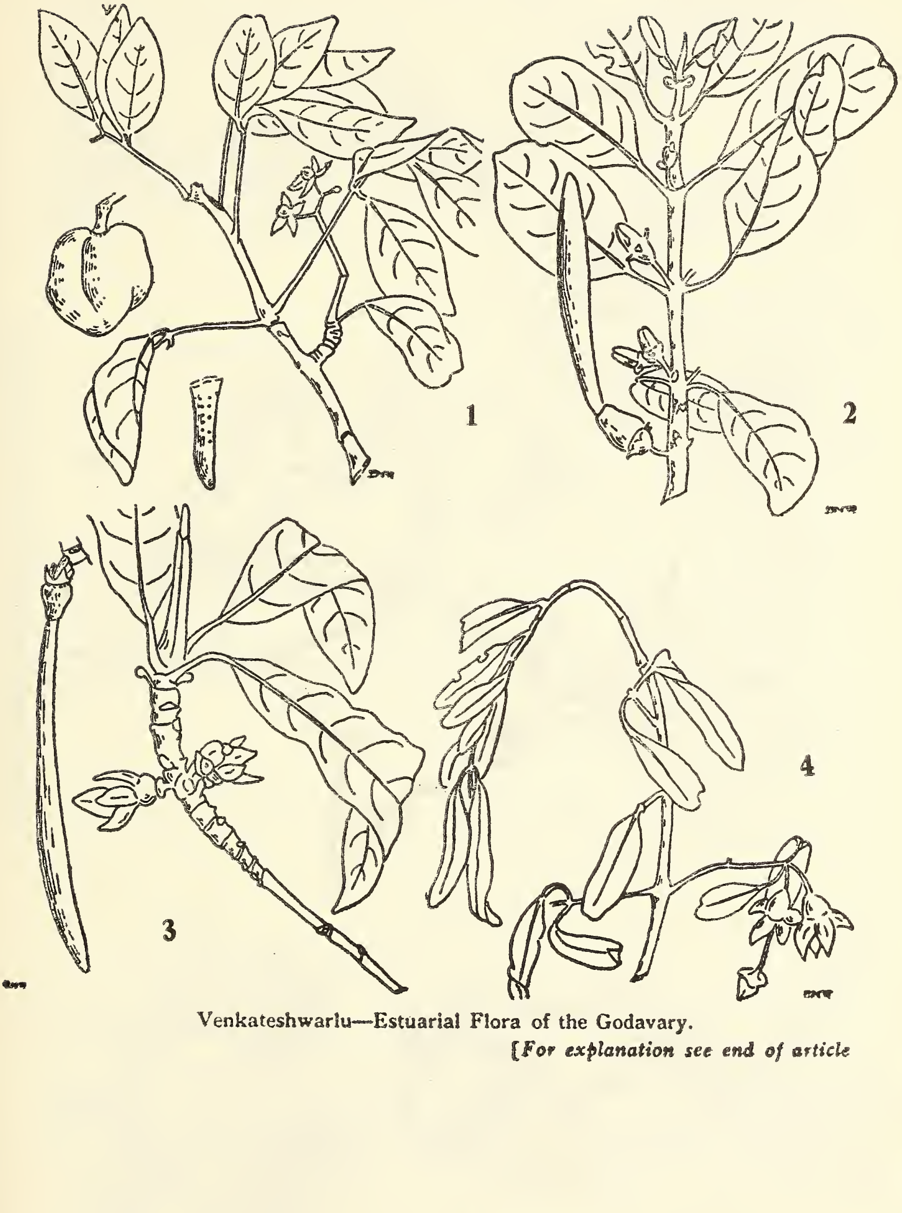
III. SONNERATIACEAE.

9. **Sonneratia apetala** Buch.-Ham., F.B.I., ii, 579.

Vern. Names: Kalingi (Tel.); Marama (Tam.).
Habit: A moderate-sized evergreen tree, giving out upright round excrescences.

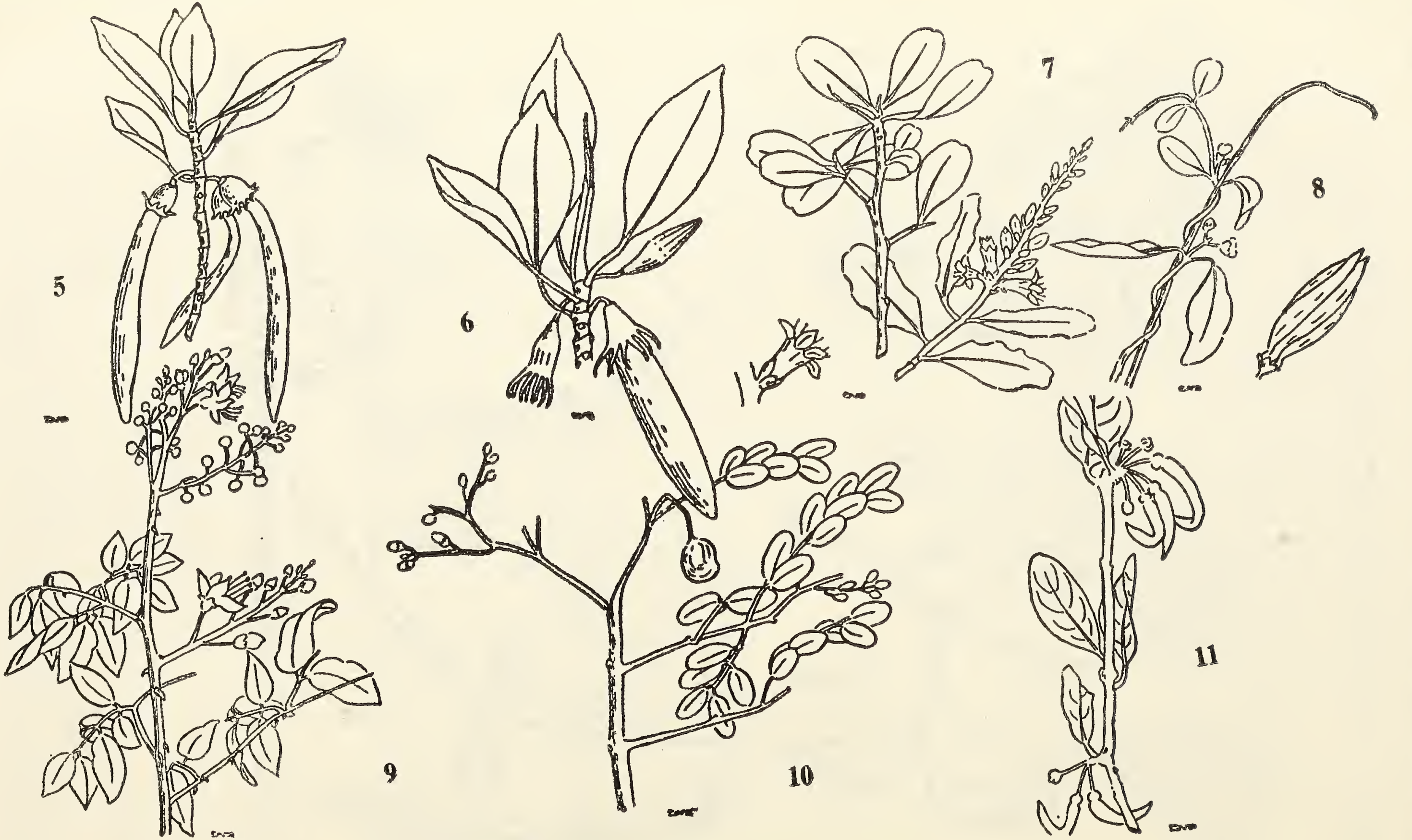
10. **Sonneratia acida** Linn. f., F.B.I., ii, 579.

Vern. Names: Pedda Kalingi (Tel.); Blatti, Thirala (Mal.).
Habit: A small evergreen tree with large showy pink-petalled flowers and large depressed globose fruit.



Venkateshwarlu—Estuarial Flora of the Godavary.

[*For explanation see end of article*



Venkateshwarlu—Estuarial Flora of the Godavary.

[*For explanation see end of article*

IV. MELIACEAE.

11. **Xylocarpus obovatus** A. Juss.

Syn: *Carapa moluccensis* Bedd., Fl. t., F.B.I., i, 567.
Vern. Names: Chenuga (Tel.); Somunthiri (Tam.); Pussur (Hind.).
Habit: A moderate-sized evergreen tree with stout and flat excrescences resembling those of *Heritiera fomes*. The fruit is a large globose 4-celled capsule.
Use: Wood dark-red and valuable.

V. COMBRETACEAE.

12. **Lumnitzera racemosa** Willd., F.B.I., ii, 452.

Vern. Names: Kadavi (Tel.); Tipparathai (Tam.).
Habit: An evergreen tree of shrubby growth with rather small leaves and white flowers.
Uses: Wood hard, greyish brown with a darker heartwood, used as posts and fuel.

VI. MYRSINACEAE.

13. **Aegiceras corniculatum** Blanco.

Syn: *A. majus* Gaertn., F.B.I., iii, 533.
Vern. Names: Guggilam (Tel.); Narikandam (Tam.); Halsi (Hind.).
Habit: A common and pretty small tree with white flowers and an elongate curved fruit 1 in. long.
Use: Mostly used for fuel, and the wood, it is said, burns quickly when raw.

VII. EUPHORBIACEAE.

14. **Excoecaria Agallocha** Linn., F.B.I., v, 472.

Vern. Names: Thilla (Tel.); Tilai (Tam.); Komatti (Mal.).
Habit: A dioecious evergreen tree.
Uses: The latex of this plant is poisonous and causes blisters on the skin, and if it falls in the eyes brings about blindness. Due to the excessive smoke that issues out while burning it is not so much valued as fuel.

VIII. ACANTHACEAE.

15. **Acanthus ilicifolius** Linn., F.B.I., iv, 481.

Vern. Names: Alchi (Tel.); Hargosa (Hind.).
Habit: A gregarious shrub with spinescent leaves reaching 5 ft. in height lining the tidal creeks.

IX. LEGUMINOSAE.

16. **Dalbergia spinosa** Roxb., F.B.I., ii, 238.

Vern. Name: Chillingi (Tel.).
Habit: A stiff, often climbing shrub with small white flowers and the tips of the branches modified into spines, which are said to be poisonous.

17. **Derris uliginosa** Benth., F.B.I., ii, 241.

Vern. Name: Nalla Theegi (Tel.).
Habit: A large evergreen climbing shrub with rose-coloured flowers and rather large leaflets.

18. **Caesalpinia nuga** Ait., F.B.I., ii, 256.

Vern. Name: Mulutige (Tel.).
Habit: An evergreen prickly plant.
Uses: Pods, roots and leaves medicinal.

X. ASCLEPIADACEAE.

19. **Sarcolobus carinatus** Wall., F.B.I., iv, 28.

Vern. Name: Pala boddu theegi (Tel.).
Habit: An evergreen twiner with fleshy follicles.
Use: The fleshy fruits are edible.

XI. BORAGINACEAE.

20. **Heliotropium Curassavicum** Linn., Gamble, Fl. Pres. Madras, Pt. v, 896.

XII. AIZOACEAE.

21. **Sesuvium Portulacastrum** Linn., F.B.I., ii, 659.

Habit: A fleshy prostrate rooting stout stemmed herb.

XIII. CHENOPODIACEAE.

22. **Arthocnemum indicum** Moq., F.B.I., v, 12.
23. **Salicornia brachiata** Roxb., F.B.I., v, 12.
24. **Suaeda maritima** Dumort., F.B.I., v, 14.
25. **Suaeda nudiflora** Moq., F.B.I., v, 14.

XIV. GRAMINEAE.

26. **Myriostachya Wightiana** Hk. f., F.B.I., vii, 327.

Habit: A tall grass reaching 6-10 ft. in height, and lies on the edges of the creeks.
Use: The leaves are used for thatching.

ACKNOWLEDGEMENTS.

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Explanation of Plates I—III.

The Estuarial Flora of the Godavary.

Plate I.

Map of the *Lower Godavary.*

Plate II.

Fig. 1. *Xylocarpus obovatus* A. Jus.
Fig. 2. *Ceriops Roxburghiana* Arn.
Fig. 3. *Rhizophora mucronata* Lamk.
Fig. 4. *Sonneratia apetala* Buch-Ham.

Plate III.

Fig. 5. *Bruguiera cylindrica* W. & A.
Fig. 6. *Bruguiera conjugata* Merr.
Fig. 7. *Lumnitzera racemosa* Willd.
Fig. 8. *Sarcolobus carinatus* Wall.
Fig. 9. *Caesalpinia nuga* Ait.
Fig. 10. *Dalbergia spinosa* Roxb.
Fig. 11. *Aegiceras corniculatum* Blanco.

NOTES ON THE FLOWERING PLANTS OF THE BILLIGIRIRANGAN HILLS.

BY

EDWARD BARNES.

The Billigirirangan Hills are situated at the S.E. corner of the Mysore Plateau. They may be described approximately as consisting of two ridges rising to nearly 6,000 ft., running north and south, and surrounded by lower hills. The western ridge slopes down on the west to an undulating plateau a few miles wide and about 4,000 ft. in elevation, locally known as the Malaikadu; this, after again rising in places, falls to the Mysore Plateau (Chamrajanagar District). The eastern ridge is longer, rather higher and more complex than the western, a number of spurs running out to the east. It falls on the east to an extension of the Mysore Plateau in the Kollegal Taluk of the Coimbatore District. There is a gap in this ridge at Bellaji. Politically these hills are about half in Mysore State and half in Coimbatore District, the border running on the north along the western ridge and on the south along the eastern ridge, and crossing the valley near Moskal.

On both ridges above about 5,000 ft. there are considerable areas of shola and short grass. The valley between the two ridges is largely filled by dense evergreen forest, part of which has been planted with coffee. The Malaikadu and most of the rest of the area at and below about 4,000 ft. is covered with deciduous forest with areas of coarse grass and some evergreen forest along the streams. The lower parts of the eastern and northern slopes are very dry. Apart from the five not very large coffee estates, these hills are almost uninhabited. A few Sholagars make clearings in the forest and raise crops, and timber is extracted from the more accessible areas, but much of the country remains virgin. The sparsity of population is due to the fact that except for the areas above about 4,500 ft. the whole region is malarious and infested with elephants.

The Billigirirangan Hills are a little over a hundred miles from the west coast, but between them and the sea, that is between the Nilgiris and Coorg, the Western Ghats are not high. Consequently these hills receive a considerable amount of rain and much mist during the S.-W. monsoon period. They are about 140 miles from the east coast and they receive also the N.-E. monsoon rains. In addition there are frequent thunder-storms during April and May. The first three months of the year are dry, but on the higher parts of the hills a rainfall of 60 to 80 inches is distributed through the rest of the year.

References to these hills in botanical literature are extremely few. Parts of these hills are included in the area covered by the collections of Mr. C. E. C. Fischer, which were described by Fr. E. Blatter in his Contribution to the Flora of North Coimbatore (*J. Bomb. Nat. Hist. Soc.*, Vol. xviii, No. 2, 1908). This contribution, however, although giving elevations at which plants occur, does not give exact localities and covers a much wider and more diversified area than the Billigirirangan Hills alone.

The collections on which the following notes are based were made during the hot weather of 1938 and 1939 and during short visits in September and December. No attempt was made to form a complete collection of the plants of these hills, but special attention was paid to a limited number of groups of plants such as the Monocotyledons other than grasses and sedges, and the Geraniaceae, Gentianaceae, Scrophulariaceae and Acanthaceae. Most herbaceous plants found in flower were collected, but trees and ferns could not be dealt with.

The following abbreviations have been used in the list :—Mal. = Malaikadu, the area of deciduous forest at about 4,000 ft. on the west of the hills. Pun. Gt. = Punjur Ghat. This ghat runs from Punjur (c. 3,000 ft.) at the foot of the hills on the north to Bedaguli (c. 4,500 ft.) at the north end of the valley between the two ridges. Dod. = Doddasampagi Reserved Forest, but only the portion between Honnametti and the Big Tree was visited (3,000-3,500 ft.). E. sl. = eastern slopes of the eastern ridge (5,000-3,000 ft.). Dup. = near Dupabari on the eastern ridge (about 5,200 ft.). At. = Attikan on the western ridge (about 5,500 ft.). (K) refers to the fact that specimens of the plant were sent to Kew where they were identified, or their identification by the writer confirmed, by Mr. C. E. C. Fischer or (in the case of the orchids) Mr. Summerhayes.

The following statements appear to be justified by this partial survey of the flora of these hills. The area is remarkably rich in orchids. Sixty-six species of orchids were collected in flower, or have subsequently flowered on being transplanted to the writer's garden at Tambaram (Chingleput District, South India), and a number of others were found, but their identification is uncertain as they have not been seen in flower. Further, two or three which seem to be new species have been sent to Kew for identification and description, but owing to war conditions work on them has had to be postponed. This means that more than one-third of the known S. Indian orchids occur in this small area. Other epiphytic plants such as *Aeschynanthus Perrottetii, Hoya pauciflora, Procris Wightiana*, Peperomias and numerous ferns and club mosses also occur profusely. Ferns in general appear to be very abundant. Parasites of the *Loranthus* and *Viscum* genera are very noticeable. On the other hand marsh plants appear to be rather scanty. Species of *Xyris, Impatiens rufescens, I. chinensis, Drosera rotundifolia, D. indica*, species of *Torenia* and most of the common Utricularias were not found in spite of careful search. In view of the limited elevation of these hills it is not surprising that such plants as *Rhododendron nilagiricum, Rosa Leschenaultiana, Anemone rivularis* and *Geranium nepalense* should not occur, but it is remarkable that such common plants as *Rhodomyrtus tomentosa, Cotoneaster bixifolia, Berberis tinctoria* and all shrubby species of *Osbeckia* should be absent. This is the more remarkable in view of the fact that these plants are common at lower elevations and in drier situations on the neighbouring Nilgiri Hills, and of the fact that many alpine plants such as *Gentiana pedicillata, Drosera peltata, Pedicularis zeylanica, Ceropegia pusilla, Parnassia mysorense* and *Viola serpens* are common on the Billigirirangans.

The serial numbers given after some species (e.g. *Thalictrum saniculaeforme* DC. . . 1979) refer to mounted specimens in the writer's herbarium.

Ranunculaceæ.

Clematis

1. **C. gouriana,** Roxb. Bel. fl. Dec.
2. **C. Wightiana,** Wall. Margins of sholas, At., Honnametti, fl. Dec.

Thalictrum

1. **T. saniculaeforme,** DC. (K) On shaded wet rocks, At., fl. Sept. 1979.
2. **T. Dalzellii,** Hook. (K) On wet rocks, At., Miskatikal, fl. Sept. 1983.

Ranunculus Wallichianus, W. & A. In sholas on both ridges, fl. May. Apparently the only buttercup on these hills.

Dilleniaceae

Dillenia retusa, Thunb. At.

Magnoliaceae

Michelia Champaca, Linn. Doddasampagi in moist deciduous forest.

A gigantic tree of this species, doubtless hundreds of years old, is venerated by the Hindus and is a place of pilgrimage from the Rangaswami temple on Bellikal Betta at the north end of these hills.

Menispermaceae

Stephania japonica, Miers. Common, evergreen forest, 4,000-5,000 ft., fl. Dec.

Cissampelos Pareira, Linn. E. sl. fl. June.

Cruciferae

Cardamine

1. **C. africana,** Linn. At.
2. **C. hirsuta,** Linn.

Violaceae

Viola serpens, Wall. Common, sholas 5,000 ft. and above, fl. and caps. May. The only violet collected on these hills.

Bixaceae

Cochlospermum gossypium, DC. Below Bel., fl. Dec., near Punjur, caps. April.

Polygalaceae

Polygala

1. **P. arillata,** Ham. Common, evergreen forest above 4,500 ft., Moskāl, fl. and fruit Sept.
2. **P. rosmarinifolia,** W. & A. Common, grassland 4,500 ft., and above, fl. May, Sept. Plants may be 20 in. high.
3. **P. chinensis,** Linn. Pun. Gt., 3,500 ft. fl. May.
4. **P. persicariaefolia,** DC. Devakeri, Mal., amongst tall grass, fl. Sept. Near Pun., fl. April.

Portulacaceae

Portulaca oleracea, Linn. Dup. 5,000 ft., fl. May.

Hypericaceae

Hypericum

1. **H. mysorense,** Heyne. 4,500 ft. and upwards, fl. May.

2. **H. japonicum,** Thurb. In marshes, 4,500 ft. and above, Moskal, fl. May.

Malvaceae

Sida rhombifolia, Linn. Mal., Dod., caps. Dec.

Urena lobata, Linn. Mal. fl. Dec.

Kydia calycina, Roxb. Common, Dod.

Decaschistia crotonifolia, W. & A. Pun. Gt. 3,500-4,000 ft., fl. June, Dec., caps. Dec.

Hibiscus

1. **H. Abelmoschus,** Linn. E.sl. 3,000 ft., fl. June, Sept.

2. **H. angularis,** Mast. Miskatikal, fl. Dec.

3. **H. Solandra,** L'Herit. N.sl., deciduous forest 3,000-4,000 ft., fl. and caps. Sept.

4. **H. Lampas,** Cav. Mal, caps. June.

Bombax malabaricum, DC. Common, Dod., fl. April.

Sterculiaceae

Helicteres Isora, Linn. Below Bedaguli, fl. Sept.

Eriolaena Hookeriana, W. & A. (K) Open deciduous forest, Mal. fl. June, caps. Dec. 1978.

Buettneria herbacea, Roxb. Pun. Gt. 3,500 ft., fl. May.

Tiliaceae

Grewia tiliæfolia, Vahl. Common, Pun. Gt., Dod., Mal., fl. June.

Linaceae

Linum mysorense, Heyne. Common, grassland, fl. Sept.

Geraniaceae

Oxalis corniculata, Linn. Throughout the area.

O. pubescens, H. B. & K. and **O. latifolia,** H. H. & K. have run wild, and are especially prolific on and near the two higher estates, Attikan and Honnametti.

Biophytum

1. **B. Candolleanum,** Wt. Frequent above 4,000 ft., Dod., fl. May, June, Sept.

2. **B. Reinwardtii,** Edgw. & Hook. f. E.sl., fl. Sept. 2193.

Impatiens

1. **I. scapiflora,** Heyne; Common on wet rocks and branches of trees exposed to the S.W. monsoon at 5,000 ft. and above, fl. Sept. Some flowers seen in May.

2. **I. cuspidata,** Wt. Frequent in sholas, 5,000 ft. and above, Honnametti, Dup., fl. and caps. June, Sept. Fl. slightly fragrant.

3. **I. Balsamina,** Linn. Common 4,000-5,000 ft. Mal., At., Bel., fl. Sept.

4. **I. fruticosa,** DC. Slopes of Kataribetta at 5,000 ft., Nagamanpadabetta at 5,500 ft., fl. Sept.

5. **I. Goughii,** Wt. Along streams on the eastern ridge, 5,000 ft. and above, fl. Sept.

Rutaceae

Murraya exotica, Linn. Common in sholas, E. ridge 5,000 ft., fl. May. Petals up to 1.25 ins. long. (F.M.P. gives .5 in.)

Atalantia

Meliaceae

Munronia Wallichii, Wt. Common in moist deciduous and evergreen forest 4,000 ft., fl. and fruit May.

Cipadessa baccifera, Miq. E.sl. 4,500 ft., fl. May.

Icacinaceae

Mappia

1. **M. oblonga,** Miers. Near Bel., fl. June. Flower foetid.
2. **M. tomentosa,** Miers. Dod., fl. June. Leaves simply tomentose beneath, corolla yellowish-green strigosely hairy, very foetid.

Celastraceae

Euonymus dichotomus, Heyne. Near Bedaguli, fl. May.

Rhamnaceae

Zizyphus rugosa, Lamk. Common in grassland and deciduous forest 4,500 ft.

Citaceae

Ampelocissus

1. **A. tomentosa,** Planch. Pun. Gt. 3,500 ft. Mature flower and fruit not seen.
2. **A. araneosa,** Planch. Near Bedaguli, fruiting Sept.

Cissus pallida, Planch. Common in deciduous forest, E.sl. 4,500 ft., fl. June.

Cayratia

1. **C. pedata,** Juss. Dup., fl. June.
2. **C. tenuifolia,** Gagnep. At., fl. May.

Leea crispa, Linn. A large herbaceous shrub. Leaves rather furry and not glabrous as stated in F.M.P. Petals green, column white, anthers purplish. A very conspicuous element in the undergrowth in deciduous forest of the Malaikadu, fl. June. 1986.

Sapindaceae

Allophyllus Rheedii, Radlk. 4,500 ft., fl. May.

Sabiaceae

Meliosma Arnottiana, Walp. Dup., fl. May.

Leguminosae

Papilionatae

Crotalaria

1. **C. ovalifolia,** Wall. At., grasslands, fl. May and June.
2. **C. umbellata,** Wt. Mal., caps. Dec. (7 seeds).
3. **C. mysorensis,** Roth. Mal., fl. Dec.
4. **C. calycina,** Schwank. Gr. 4. At. grasslands, caps. Dec.
5. **C. dubia,** Grah. Dod., fl. Dec.
6. **C. laevigata,** Lamk. Pun. Gt. 4,000 ft., fl. Sept., Mal., fl. and caps. Dec.

Indigofera pulchella, Roxb. Mal., E.sl., fl. Dec.

Tephrosia tinctoria, Pers. Pun. Gt. 3,000 ft., fl. Sept..

Smithia

1. **S. gracilis,** Benth. (probably) Marshy places in grasslands, fl. Dec.
2. **S. hirsuta,** Dalz. Summit of Anaibetta, fl. May.

Pycnospora hedysaroides, R. Par. Pun. Gt. 4,000 ft., Mal., fl. May.

Alysicarpus racemosus, Benth. Grassland near At., caps. Dec.

Desmodium

1. **D. laxiflorum,** DC. Dod., fl. Dec.
2. **D. Scalpe,** DC. At., fl. Dec.
3. **D. triquetrum,** DC. Mal.
4. **D. gangeticum,** DC. Mal., Pun. Gt. 4,000 ft. in undergrowth, fl. May. White-flowered, stamens 9 + 1.
5. **D. polycarpum,** DC. (probably) var. trichocaulon, Bak. Mal., fl. Sept.
6. **D. gyrans,** DC. Mal., fl. Sept., pods Dec.

Shuteria vestita, W. &. A. Mal., fl. and pods Dec.

Dumasia villosa, DC. At., fl. Sept.

Butea frondosa, Koen. Pun. Gt. 3,500 ft., fl. August.

Phaseolus Mungo, Linn. Mal., pods Dec.

Atylosia rugosa, W. & A. Grasslands 5,000-6,000 ft., fl. Sept., pods Dec.

Rhynchosia

1. **R. rufescens,** DC. Mal., fl. and pods Dec.
2. **R. cyanosperma,** Benth. Mal., fl. Dec.

Flemingia

1. **F. strobilifera,** R. Br. Mal., fl. Dec.
2. **F. Grahamiana,** W. & A. Fl. Dec.
3. **F. nilgheriensis,** Wt. Kataribetta, fl. Sept.

Pterocarpus Marsupium, Roxb. Dup., Moskal, Mal., fl. May.

Sophora glauca, Lesch. Common 4,000 ft. and above, fl. May.

CAESALPINOIDEAE

Caesalpinia sepiaria, Roxb. Pun. Gt., margins of sholas 5,000 ft., fl. Dec., pods May and June.

Cassia

1. **C. hirsuta,** Linn. (or laevigata?) near Bedaguli, fl. and pods June, Sept.
2. **C. Leschenaultiana,** DC. Grasslands 5,000 ft., fl. Sept.

Bauhinia variegata, Linn. Pun. Gt. 3,000 ft., fl. Dec.

MIMOSOIDEAE

Entada scandens, Benth. Near Bedaguli.

Acacia concinna, DC. Pun. Gt. Bedaguli, fl. June.

Rosaceae

Rubus

1. **R. fulvus,** Focke. Common, margins of sholas, 5,000 ft., fl. and fruits May, June.

2. **R. ellipticus**, Sm. Common, margins of sholas, 5,000 ft., fruit Dec.

Saxifragaceae

Parnassia mysorense, Heyne. Very common in wet places amongst rocks above 5,000 ft., fl. June-Sept.

Crassulaceae

Kalanchoe

1. **K. glandulosa**, Hocket, (K) Mal., on rocks, fl. Dec. Identified by C. E. C. Fischer, but calyx lobes divided to base. 2087.

2. **K. olivacea**, Dalz. At., on rocks, fl. Jan. Calyx and corolla lobes with short curved tails.

3. **K. Bhidei**, T. Cooke. Below Bel., on rocks, fl. Dec. 2078.

4. **K. laciniata**, DC. (K) E.sl. 4,000 ft., fl. Dec. 2089, 2091. Leaves with three leaflets only.

Droseraceae

Drosera peltata, Sm. Very common, grassland and on wet rocks, 5,000 ft. and above, fl. June, Sept.

Haloragidaceae

Myriophyllum intermedium, DC. Attikan Tank, Devakeri, fl. Dec. 2063.

Combretaceae

Terminalia crenulata, Roth. Moskal, Mal., fl. May.

Myrtaceae

Eugenia bracteata, Roxb. ?, below Bedaguli, fl. May.

Melastomaceae

Osbeckia cupularis, Don. Grassland, 5,000 ft. and above, fl. Sept.

Onagraceae

Jussieua suffruticosa, Linn. In marshes and along streams, 4,000 ft., Dod., below Bedaguli, fl. and seed June.

Oenothera rosea, Ait. A very common weed at 5,000 ft.

Passifloraceae

Passiflora edulis, Sims. Run wild and very common above 4,000 ft. Climbing to and pendant from the tops of tall trees on edges of sholas. Ripe fruit May-Sept.

Cucurbitaceae

Trichosanthes villosula, Cogn. (K) Dup., fl. Sept., Bel., fl. May, 1980-2. Nand. At., fl. May.

Byronopsis laciniosa, Nand. At., fl. May.

Melothria

1. **M. perpusilla**, Cogn., Dup.-Moskal, fl. June.

2. **M. amplexicaulis**, Cogn. At., fl. May.

3. **M. leiosperma**, Cogn. (probably) Dup., fl. Sept.

Begoniaceae

Begonia malabarica, Lamk. Frequent along streams in evergreen forest at 4,500 ft., fl. May and June.

Aizoaceae

Mollugo pentaphylla, Linn. Devakeri, 5,000 ft., fl. May.

Umbelliferae

Hydrocotyle javanica, Thunb. Sholas, 5,000 ft. and above, fl. May, June, Sept.

Bupleurum virgatum, W. & A. Margins of sholas, 5,000 ft. and above, At., fl. May.

Pimpinella monocia, Dalz. Grassland, Dup., fl. Sept.

Heracleum Candolleanum, Gamble. Grassland, 5,000 ft. and above, fl. Sept.

Araliaceae

Schefflera

1. **S. stellata,** Harms. E.sl. 4,500 ft., fl. June.
2. **S. Wallichiana,** Harms. Dup.

Caprifoliaceae

Lonicera Leschenaultii, Wall. Dod., Mal., fl. June.

Rubiaceae

Wendlandia Notoniana, Wall. Common, margins of sholas, grasslands at 4,-5,000 ft., fl. May.

Oldenlandia

1. **O. herbacea,** Roxb. Dup., fl. Sept.
2. **O. dichotoma,** Koen. Forest undergrowth and grasslands, 5,000 ft., Devakeri, fl. June-Sept.

Anotis

1. **A. quadrilocularis,** Benth. & Hook. Devakeri, fl. Sept.
2. **A. monosperma,** Benth. Kataribetta, fl. Sept., above Dup., fl. May. Flower white.

Ophiorrhiza hirsutula, Wt. Moist banks in evergreen forest, 4,500 ft., fl. May. Usually semiprostrate and herbaceous, sometimes erect and suffruticose. 1949.

Mussaenda laxa, Hutch. (or glabata?) In thickets along streams in deciduous forest at 4,500 ft., fl. and fruit June.

Chomelia asiatica, O. Kze. var. rigida, Gamb. Margins of sholas, E. ridge, fl. May.

Randia Brandisii, Gamble. Common, deciduous forest 3,000-4,000 ft., fl. and fruit May and June. Flowers first white, then bright yellow.

Knoxia

1. **K. mollis,** W. & A. Mal., fl. June.
2. **K. Wightiana,** Wall.

Plectronia didyma, Kurz, var. **umbellata,** Gamb. Shola forest, 5,000 ft.

Ixora Notoniana, Wall. Shola forest, fl. May. Flowers red on trees in the open, e.g. near summit of Anaibetta, white on those in sholas.

Pavetta

1. **P. breviflora, DC. var. glaberrima,** Brem. Dod., fl. May. Very fragrant.
2. **P. tomentosa,** Linn. Common, open deciduous forest, 4,000 ft., fl. May.

Psychotria

1. **P. Thwaitesii,** Hook. f. Common in sholas, Dup. fl. May. Calyx lobes very small and oblique.
2. **P. elongata,** Hook. f. Common, sholas 5,000 ft., Dup., fl. May.
3. **P. bisulcata,** W. & A. Sholas, 5,000 ft., fruit June.

Chasalia curviflora, Thw. Sholas E. ridge, fl. May and June. 2138.

The mechanism for cross-fertilisation is interesting. The corolla tube is long and the lobes are short, valvate and bright yellow. On first opening, the lobes remain attached at their tips but separate below so that there are 5 wide slits. The 2-lobed stigma is opposite these slits but the anthers are within the upper part of the tube. Later the corolla lobes separate completely and become recurved and the tube splits for some distance down one side. The anthers that thus become exposed then curve outwards.

Lasianthus coffeoides, Fys. Dup., fl. May.

Borreria

1. **B. stricta,** K. Sch. Fl. Sept.
2. **B. ocymoides,** DC.? Caps. June.

Rubia cordifolia, Linn. E.sl., fl. Sept. At., fl. Dec.

Compositae

Vernonia

1. **V. Monosis,** C. B. C. Very common in sholas on the eastern ridge, 5,000 ft., fl. April, seeds May.
2. **V. divergens,** Edgw. Common, fl. Dec.
3. **V. cinerea,** Less. Common, fl. May.

Elephantopus scaber, Linn. Mal.

Conyza stricta, Willd. Grasslands, 5,000 ft., fl. Sept.

Blumea membranacea, DC. Fl. Dec.

Laggera alata, Sch.-Bip. Fl. Dec.

Blepharisperma subsessile, DC. Pun. Gt., 3,000 ft., fl. June.

Anaphalis

1. **A. subdecurrens,** Gamble. Kataribetta, fl. Sept., May.
2. **A. Lawii,** Gamble. Grasslands, Dup., fl. Sept., Dec.

Helichrysum buddleioides, DC. At., fl. Dec.

Vicoa indica, DC. Mal., fl. Dec.

Siegesbeckia orientalis, Linn. Dod., Mal., fl. Dec.

Spilanthes acmella, Murr. Mal., fl. Dec.

Bidens pilosa, Linn. A very common and troublesome weed, 4,000-5,500 ft.

Tridax procumbens, Linn. Pun. Gt. 3,000 ft.

Artemisia parviflora, Buch.-Ham. Very common on grassland, fl. Sept., Dec.

Emilia

1. **E. scabra,** DC. Anaibetta and other hilltops, 5,500-6,000 ft., fl. May.
2. **E. sonchifolia,** DC. Grasslands, 5,000 ft., fl. Sept.

Notonia grandiflora, DC. E.sl., 4,000 ft.

Senecio

1. **S. Edgeworthii,** Hook. f. Slopes of Kataribetta, 5,500 ft., fl. May. Mal. on rocks, fl. Dec.
2. **S. corymbosus,** Wall. At., fl. Dec.
3. **S. intermedius,** Wt. At., fl. Dec.

Crepis acaulis, Hook. f. Anaibetta.

Erechthites valerianifolia, DC. Dod. below Honnametti, fl. May.

Guizotia abyssinica, Cass. Cultivated by the Sholagas and run wild.

Eupatorium glandulifera has invaded the western ridge, especially common near Honnametti and At., 5,000 ft. and above.

Campanulaceae

Lobelia

1. **L. trigona,** Roxb. In marshes, Bel., Dod., fl. May and June.

2. **L. trialata,** Buch.-Ham. On wet rocks, Moskal, Devakeri, Honnametti, fl. Sept. 1920.

3. **L. nicotianaefolia,** Heyne (probably var. **trichandra** C.B.C.) In deciduous forest, Mal., fl. Dec.

4. **L. excelsa,** Lesch. On the borders of sholas, 5,000 ft. and above, At., May, Dec. Leaves glabrous above, softly hairy below, corolla tube purplish, lobes white or yellowish.

Cephalostigma flexuosum, Hook. f. Mal., fl. Dec.

Campanula fulgens, Wall. Frequent in grassland, east ridge, 5,000 ft., fl. Sept.

Myrsinaceae

Ardisia solanacea, Roxb. Common, evergreen forest along streams at 4,000 ft. Dod., Moskal, fl. May, Dec.

Symplocaceae

Symplocos spicata, Roxb. Common in sholas, Dup., fl. June.

Oleaceae

Jasminum

1. **J. Rottlerianum,** Wall. Near At., fl. May.

2. **J. Ritchiei,** C.B.C. Mal.

3. **J. brevilobum,** A. DC. fl. Sept.

4. **J. flexile,** Vahl. Mal., fl. Dec. Very sweet-scented.

Linocera intermedia, Wt. Pun. Gt., 4,000-5,000 ft., fl. June.

Olea glandulifera, Wall. Sholas, At.

Ligustrum Perrotetti, A. DC. Common on margins of sholas, 5,000 ft., fl. May.

Apocynaceae

Rauwolfia densiflora, Benth. Margins of sholas, At.

Aganosma cymosa, G. Don.

Asclepiadaceae

Cryptolepis Buchanani, R. & S. Common above Bedaguli, 4,500 ft., fl. May.

Holostemma annulare, K. Schum. Pun. Gt., 4,000 ft., fl. Sept.

Cynanchum pauciflorum, R. Br. Near Honnametti, fl. Dec. (probably; follicles not seen).

Sarcostemma Brunonianum, W. & A. E.sl., Gundimala up to 5,000 ft., fl. Sept. Has a heavy scent.

Tylophora

1. **T. fasiculata,** Ham. Grassland near At., fl. May.

2. **T. capparidifolia,** W. & A. At., fl. June.

Hoya pauciflora, Wight. Common on shola trees 4,500-5,500 ft., fl. May, seeds Sept. 2223.

Hoya pendula, Wt.? Dup., fl. May.

Ceropegia

1. **C. pusilla,** W. & A. Common on the eastern ridge 5,000-6,000 ft. usually in rock crevices on hilltops, Kataribetta, Dup., fl. May and June, follicles Sept. 1876-7.

2. **C. fimbriifera,** Bedd. Mal. 4,000 ft. in pockets of earth on slab rock, E.sl. below Dup. 5,000 ft., fl. June, 1874-5, 2220. The flowers are described as solitary in F.M.P. There is a peduncle with two buds only one of which matures. Corolla lobes bright green inside, outside and up to about ¼ of the tube dark purple, tube outside light green, glab. inside dark purple with vertical white stripes.

3. **C. elegans,** Wall. Mal., fl. Sept. 2105.

4. **C. candelabrum,** Linn. E.sl., fl. Sept. 2221. Corolla lobes greenish-yellow below, purple at tips, ciliate within.

Caralluma (Boucerosia) lasiantha, N.E. Br. Amongst rocks at 4,000-5,000 ft. E.sl., fl. June. Flowers not strictly umbelled, but inflorescence repeatedly branched so as to form a head. Bracts slender cylindrical ciliate on upper 1/3, yellowish. Corolla at back glabrous subglossy, white at centre deepening to crimson almost black at tips of lobes, upper surface crimson-black velvety with straggling hairs, outer surface of corona cream, lobes and inner surface blackish-crimson. Smell very offensive.

Loganiaceae

Fragraea obovata, Wall. Common and conspicuous in sholas, 4,000-5,000 ft., fl. May, June.

Gardneria ovata, Wall. Common on margins of sholas, 5,000 ft., fl. May.

Gentianaceae

Exacum bicolor, Roxb. Common and conspicuous in grassland, 5,000 ft., fl. Sept. Caps. June. Corolla white and purple.

Gentiana pedicellata, Wall. var. **Wightii,** Kusn. Common, grassland at 5,000 ft. and above, fl. June, Sept.

Canscora

1. **C. diffusa,** R. Br. Western slopes, 4,500 ft., fl. Dec.

2. **C. decussata,** Roem and Sch. Mal., Pun. Gt., fl. Dec.

Swertia

1. **S. minor,** Knobl. Frequent in short grass above 5,000 ft., fl. Sept. Flowers blue.

2. **S. angustifolia,** Buch.-Ham. var. **pulchella,** Burk. Mal. 4,500 ft., fl. Dec. Petals white marked with dark blue, scale of nectary green.

3. **S. trichotoma,** Wall. At. on grasslands, Petals smaller than given in F.M.P. but acuminate. No scale on nectary.

4. **S. corimbosa,** Wt. At. 5,000 ft., fl. Dec.

Boraginaceae

Trichodesma zeylanicum, R. Br. Near Dup., fl. Sept.

Cynoglossum denticulatum, A. DC. var. **zeylanicum** C.B.C. Common, deciduous forest and margins of sholas, 4,000-5,000 ft., fl. June.

Convolvulaceae

Argyreia

1. **A. cuneata,** Ker.-Gawl. Common Pun. Gt., fl. May.

2. **A. nellygherrya,** Choisy. Pun. Gt. 4,500 ft., fl. June. Flower rose-purple.

3. **A. sericea,** Dalz. & Gibs. Dup., fl. Sept. 2,222.

Cnovolvulus flavus, Willd. Common on grassland near Dup. 5,500 ft., fl. May, Bel.

Cuscuta reflexa, Roxb. Common on *Strobilanthes,* At., fl. Dec.

Solanaceae

Solanum

1. **S. nigrum,** Linn. Dod., fl. May.
2. **S. denticulatum,** Blume. Margins of sholas, E. ridge, fl. May.
3. **S. giganteum,** Jacq. Common, margins of sholas.
4. **S. torvum,** Swartz. E. ridge, 4,500 ft., fl. and fruit May.
5. **S. indicum,** Linn. Pun. Gt., fl. May.

Scrophulariaceae

Limnophila

1. **L. hirsuta,** Benth. Marshes near Bel. 4,500 ft., fl. May. 1987, 2108.
2. **L. gratioloides,** R. Br. var. **elongata** Benth. At. pond 5,000 ft., fl. Dec. 2075.

Dopatrium junceum, Buch.-Ham. Devakeri, fl. Sept.

Vandellia pedunculata, Benth. In elephant swamps near Dod. 4,000 ft., fl. June. 2107.

Ilysanthes

1. **I hyssopioides,** Benth. Pool near summit of Anaibetta (5,700 ft.) Devakeri (5,000 ft.), fl. May, Sept. 2118.
2. **I. veronicaefolia,** Urban. Common along streams 4,500-5,500 ft., fl. May, Sept. 1951, 2109.

Buchnera hispida, Ham. Common, deciduous forest 4,500 ft., Mal., fl. Dec. 2069, 2070.

Striga

1. **S. lutea,** Lour. Common amongst grass throughout the area, fl. June, Sept.
2. **S. euphrasioides,** Benth. E.sl. 5,000 ft., fl. Sept. (small form). Pun. Gt. 3,500 ft., fl. Sept. (very scabrous form up to 13 ins. high).

Sopubia trifida, Ham. Common amongst coarse grass at 5,000 ft., fl. June, Dod., fl. May. This plant does not appear to have been recorded as parasitic. An examination of the root system of a number of plants found on these hills showed it to be a root parasite on cotton grass and several other grasses.

Pedicularis zeylanica, Benth. Common, grasslands at 5,000 ft., fl. Sept. The plant found is the diffuse form with white or very pale pink flowers; the erect form with deep pink flowers does not appear to occur.

Calceolaria mexicana, Benth. is common in damp places above about 4,000 ft.

Lentibulariaceae

Utricularia

1. **U. uliginosa,** Vahl. Moist places in grassland, fl. June, Sept.
2. **U. graminifolia,** Vahl. Margin of stream, Moskal, fl. June, Dec.
3. **U. striatula,** Sm. On wet rocks, Moskal—At., fl. Sept.

Gesneriaceae

Aeschynanthus Perrottetii, A. DC. Very common on trees in sholas at 5,000 ft. and above, fl. Sept., caps. Dec. Corolla tube scarlet, lobes dark purple marked with yellow : glandular hairs on margins of lobes only.

Didymocarpus tomentosa, Wt. In rock crevices on hilltops, 5,000 ft. and above, fl. May, caps. June.

Klugia Notoniana, A. DC. Along streams at 4,000 ft., and above, Bedaguli, At., fl. May, Dec.

Bignoniaceae

Radermachera xylocarpa, K. Schum. Mal., fl. April

Acanthaceae

Thunbergia fragrans, Roxb. Common, 4,000-5,000 ft., fl. June, Sept., Dec.

Meyenia Hawtayneana, Nees. Pun. Gt. at 3,500 ft. on stony hillside, fl. May, ripe caps. Sept. Three forms with differently coloured corollas were found growing together: (1) tube orange, lobes white; (2) tube orange, lobes violet; (3) tube orange, lobes mauve.

Ruellia Beddomei, C. B. Clarke. Pun. Gt. 3,500 fit., fl. Sept. Not previously reported from S. India.

Micranthus oppositifolius, Wendl. Dod., fl. Dec.

Strobilanthes

1. **S. Kunthianus,** T. And. Very common in grassland at 5,000 ft. and above. Considerable areas of grassland are almost completely occupied by this plant.

2. **S. pulneyensis,** C.B.C. Frequent as undergrowth in sholas and evergreen forest at 4,500 ft. Dod., Bel. General flowering June 1938, plants dead 1939.

3. **S. Heyneanus,** Nees. Common in sholas and evergreen forest, growing with the above. In full flower Sept. 1938.

4. **S. luridus,** Wt. Forming a dense undergrowth in many sholas at 4,500-5,500 ft. Not seen in flower in 1938 or 1939.

5. **S. foliosus,** T. And. (probably, not in flower). In shola forest above 5,000 ft. forming an impenetrable undergrowth and becoming a small tree.

Andrographis

1. **A. alata,** Nees. Near Pun., fl. April.

2. **A. Neesiana,** Wt. Pun. Gt., 3,000-4,000 ft., fl. June.

3. **A. lineata,** Nees. Pun. Gt. 3,500 ft., fl. June. Margins of sholas 5,000 ft., fl. Dec.

4. **A. serpyllifolia,** Wt. Pun. Gt. 3,000-3,500 ft., fl. May, June.

Barleria

1. **B. involucrata,** C.B.C. Margins of sholas on both ridges Nees. var. **elata,** C.B.C. at 5,000 ft., At., fl. Dec., Dup., fl. Sept. A very beautiful shrub up to 10 ft. high in favourable places.

2. **B. sp.** (very near **B. Gibsoni,** Dalz., K.) Pun. Gt. 3,500 ft., fl. Sept. Corolla tube 1·5 in. or more, dark purple, white at base, more or less dilated below and narrowly funnel-shaped above, finely glandular, lobes quite white, ovate ·75 in. long. A branching undershrub up to about 2 ft. high.

3. **B. Morrisiana,** Barnes and Fischer (*Kew Bull.* No. 10, 1939) Pun. Gt. 3,000-3,500 ft., fl. April and May. Leaves dull green above pale below, mid-rib reddish, margin reddish hispid. Stem dark red sparingly hispid. Outer pair of calyx lobes reddish-brown, green near mid-rib. Corolla tube white, lobes mauve, 5 stamens all fertile, pollen profuse.

Asystasia violacea, Dalz. Margins of sholas 5,000 ft. Along streams 4,000-4,500 ft., fl. and caps. May and June. Flowers mauve. The leaves often have crenulate margins and it is very difficult to decide whether this plant should be classified as A. violacea, Dalz. or A. crispata, Benth.

Rungia parviflora, Nees. var. pectinata, C.B.C. Mal., fl. Dec.

Dichoptera cuneata, Nees. Mal., fl. June.

Justicia

1. **J. Betonica**, Linn. Pun. Gt. 3,000 ft., fl. Sept.

2. **J. nilgherrensis**, Wall. In dry stony ground, Pun. Gt. 3,000-3,500 ft., fl. and caps. May and June.

3. **J. procumbens**, Linn. (?) Mal., fl. Dec.

4. **J. simplex**, D. Don. (?) Dup., fl. Sept.; Mal., fl. Dec. Diffuse, silvery hairs.

5. **J. diffusa**, Will. Dup., fl. June.

Rhinacanthus communis, Nees. Deciduous forest, Mal., fl. Dec.

Verbenaceae

Lantana indica, Roxb. E.sl. 4,500 ft., fl. May.

Stachytapheta indica, Vahl. Bedaguli, stream bank, fl. Sept.

Callicarpa lanata, Linn. Common on margins of sholas on both ridges, 5,000 ft., fl. May.

Clerodendron

1. **C. serratum**, Spreng. Common in deciduous forest, 4,000 ft., fl. June.

2. **C. infortunatum**, Linn. Common on margins of sholas, At., Sept.

Vitex altissima, Linn. Pun. Gt. 3,000 ft., fl. May.

Labiatae

Orthosiphon diffusus, Benth. Pun. Gt., 3,500 ft., fl. May, Sept.

Plectranthus

1. **P. nilgherricus**, Benth. E.sl. 4,500 ft., fl. Dec.

2. **P. Coetsa**, Buch.-Ham. Very common in grassland at 4,500-5,000 ft. In places the grassland has been densely invaded.

3. **P. coleoides**, Benth. Mal. in moist places, 4,000 ft., fl. Dec.

Coleus

1. **C. barbatus**, Benth. Anaibetta, 5,500 ft., fl. Sept.

2. **C. malabaricus**, Benth. Dup., fl. Dec.

Anisochilus

1. **A. carnosus**, Wall. Mal., on rocks in deciduous forest, E.sl., 3,000 ft., fl. Dec.

2. **A. dysophylloides**, Benth. Hilltops above Dup., fl. Dec.

Pogostemon

1. **P. pubescens**, Benth. E.sl. 4,500 ft., fl. Dec.

2. **P. speciosus**, Benth. Mal., fl. Dec.

Dysophylla auricularia, Blume. At., fl. Dec.

Scutellaria

1. **S. violacea**, Heyne. In sholas, 5,000 ft. and above, fl. May-Sept.

2. **S. Colebrookiana**, Benth. (K) At. and the western slopes in grassland, fl. Dec. 2074. Flowers crimson.

Leucas

1. **L. zeylanica**, R. Br. At.

2. **L. montana**, Spreng. (K) Bel., fl. June. A shrubby plant up to 5 ft. high.

3. **I marrubioides**, Desf. (K) Below Bel., fl. Sept.
4. **I. hirta**, Spr. Pun. Gt. 3,500 ft., fl. Sept.
5. **L. prostrata**, Gamble. Dup., fl. May.

Gomphostemma Heyneanum, Wall. var. *Rottleri*, Prain. Mal., fl. Sept.

Amarantaceae

Celosia sp. Devakeri.

Banalia thyrsiflora, Moq. Dod., fl. May.

Polygonaceae

Polygonum

1. **P. plebejum**, R. Br. Devakeri, fl. April.
2. **P. glatrum**, Willd. Devakeri, in water, fl. May.
3. **P. barbatum**, Linn. Near Punjur, fl. June.
4. **P. flaccidum**, Meissn. Mal., Dod., fl. May.
5. **P. punctatum**, Buch.-Ham. Devakeri, fl. Sept.
6. **P. chinense**, Linn. At., fl. May, Sept., Dec.

Piperaceae

Piper hymenophyllum, Miq. Marshes near Bedaguli, Mal., At., fl. May, June.

Peperomia

1. **P. Heyneana**, Miq. Dup., At., fl. June. (or Wightiana in F. N. C.?)
2. **P. portulacoides**, A. Dietr. Bedaguli, fl. June.
3. **P. dindigulensis**, Miq. On rocks along stream below Bedaguli.

Elæagnaceae

Elaeagnus Keloga, Sch. Margins of sholas, At., fl. Dec. Very sweet-scented.

Loranthaceae

Loranthus

1. **L. Wallichianus**, Sch. Dod., fl. June.
2. **L. intermedius**, Wt. Dup., fl. May.
3. **L. cordifolius**, Wall. Below Dup., fl. June, on *Grewia tilaefolia*, Vahl.
4. **L. bracteatus**, Heyne. E.sl. 4,000 ft., fl. June on *Grewia* sp.
5. **L. tomentosus**, Heyne. Dod. On *Viscum orbiculatum* which was on Pavetta tomentosa.
6. **L. recurvus**, Wall. Dup.-Moskal, fl. Sept.
7. **L. courtallensis**, Gamble. Dod., Dup., fl. June on *Grewia tilaefolia*, Vahl.
8. **L. neelgherrensis**, W. & A. Dup., fl. Sept.

Elytranthe loniceroides, Engler. Mal., fl. May, on *Grewia tilaefolia*, Vahl.

Viscum

1. **V. orbiculatum**, Wt. (?) Dod., fl. May, on *Pavetta tomentosa*. Most flowers of triads ♀ only, occasionally one ♂ in centre of triad, and other two flowers not open. Used as host by *Loranthus tomentosus*.
2. **V. angulatum**, Heyne. At., fl. June, on *Olea glandulifera*, Wall.
3. **V. articulatum**, Burm. var. *dichotomum*, Kunz. Dimbam Ghat, fl. April.

Euphorbiaceae

Euphorbia

1. **E. cristata**, Heyne. Pun. Gt. 3,500 ft., fl. June (erect form 10 ins. high).
2. **E. Rothiana**, Spr. On margins of sholas, 5,000 ft., fl. May.

Bridelia retusa, Spreng. E.sl. 4,000 ft., fl. April.

Phyllanthus, simplex, Retz. E.sl., fl. Sept.

Reidia floribunda, Wt. Banks of stream below Bedaguli, fl. May.

Embelica officinalis, Gaertn. Common up to 5,000 ft.

Breynia patens, Rolfe. Pun. Gt., fl. May.

Glochidion velutinum, Wt.

Bischofia javanica, Bl. Used as shade for coffee.

Mallotus Beddomei, Hook. f. Fl. May.

Homonoia riparia, Lour. Stream bed near Bedaguli, fl. May. A small shrub 2-3 ft. high.

Acalypha brachystachya, Hornem. At., fl. Sept.

Moraceae

Ficus

1. **F. Arnottiana**, Miq. E.sl. between rocks, 4,000 ft.
2. **F. glomerata**, Roxb. Common in sholas, At. Receptacles mature Sept.

Artocarpus integrifolia, Linn. Sholas, 5,500 ft., At. apparently wild.

Dorstenia indica, Wt. At., fl. Sept.

Urticaceae

Girardinia zeylanica, Dcne. Dod. in swamps, fl. Dec.

Procris Wightiana, Wall. At., fl. Dec. Growing on trees, the stems becoming flaccid and hanging down in the dry months.

Pilea trinerva, Wt. Along streams in sholas, Dod., Dup., fl. June.

Burmanniaceae

Burmannia caelestis, Don. In marshy places, not frequent, Moskal, fl. June, Sept., Dec. 1967, 2064. Flowers blue, stems up to 4.5 ins. long, sometimes branching from near the base.

Orchidaceae

Oberonia

1. **O. iridifolia**, Lindl. var. *denticulata*, Hook. f. On shaded branches of trees along streams at about 4,000 ft., Mal. Bedaguli, fl. Sept., caps. June. 1931, 1959. Flowers have pedicels as long as the ovaries, and are not sessile as stated in F.M.P.
2. **O verticillata**, Wt. On exposed branches of trees at 5,000 ft., Devabetta slopes, fl. Sept. 1930.
3. **O. Brunoniana**, Wt. Common on trees and shrubs at 5,000 ft. At., fl. Sept. and later. 1940. The leaves are usually very thick and dull brownish.
4. **O. Lindleyana**, Wt. On branches of trees in sholas at 5,000 ft., At., fl. Sept. 2083. 2104. Sepals, petals and lip straw-coloured except the concave hemispherical disc which is orange-brown. Transplanted to Tambaram, where it flowered Dec., Jan.

Microstylis

1. **M. versicolor,** Lindl. Common in sholas at 5,000 ft. upwards, fl. Sept. Plants are usually scattered but in places dense patches were found occupying exclusively several square feet of ground.

2. **M. Stocksii,** Hook. f. In sholas at 5,500 ft. Dup., fl. June, caps. Sept. 1906. Flowers pale amber.

3. **Microstylis sp.** ? On big rock on Attikan-Moskal bridlepath, fl. Sept. Sepals and petals dark crimson to liver-coloured; lip bright chrome yellow, column pale yellow. Scape bright purple. Bracts purple becoming green at tip. Capsule purple.

Liparis

1. **L. platyphylla,** Ridl. In deciduous forest, western slopes 4,000-5,000 ft., fl. Sept. 1902. Sepals and petals pale orange, lip dull orange to pale olive green, surface dull except for a glossy central area. Flowers somewhat unpleasant-smelling.

2 **L. Wightiana,** Thw. In rock crevices on summit of hill on east ridge, 5,500 ft., fl. Sept. 2181-2. Scape dark crimson, square with 2 smaller ribs on each face. Leaves bright green. Sepals and petals very pale green or yellow; lip dull purplish, central area glossy and greenish, calli green. Pokki Betta, fl. Aug., lip yellowish-green.

3. **L. odorata,** Wt. (Lindl.) Indeciduous forest, western slopes, 4,000-5,000 ft., fl. July, caps. Sept. 1880-81. Sepals, petals and lip liver-coloured to dark crimson; column whitish.

4. **L. atropurpurea,** Lindl. 4,000-5,000 ft., fl. Sept. 1961. Belagi, At., fl. Aug. Common.

Dendrobium

1. **D. nanum,** Hook. f. At. Very common at 4,500-5,500 ft. on branches of isolated trees especially *Wendlandia Notoniana*, fl. June-Sept., caps. June. 1927. Sepals and petals white. Mid-lobe of lip greenish with a white-fringed margin, a pale green strap-shaped palate with a toothed end running along the upper side of the claw and ending near the middle of the lobe; side lobes greenish spotted and veined purple, margins toothed. Flowers honey-scented.

2. **D. nutans,** Lindl. On branches of trees on margins of sholas on the eastern ridge at 5,500-5,800 ft., fl. April and May. 1883, 2126. Sepals and petals deep yellow, lip orange, with 3 wavy ridges.

3. **D. macrostachyum,** Lindl. On trees near Moskal, 4,500 ft., fl. May. 1884. Sepals and petals pale greenish-yellow, lip yellowish with crimson veins, margin fimbriate, hairy on veins. Flowering stems covered with the silvery grey-veined leaf bases. Flowers scented.

4. **D. heterocarpum,** Wall. Frequent throughout the area on tree trunks at 4,500-5,500 ft., fl. Dec. and Jan. 1939, 2076-7, 2082. Sepals and petals pale yellow or greenish-yellow, disc of lip covered with chocolate or brownish-purple gland-like hairs with round white tips. Flowers very delicately sweet-scented. Flowers only on branches from which the leaves have disappeared, 2 or 3 at a node, very shortly racemed.

Bulbophyllum

1. **B. fusco-purpureum,** Wt. Very common on branches of trees in shola forest, at 5,000 ft., fl. May. 1897. Sepals dull yellow and purplish, lip dark purple, lighter on under side, lateral petals purplish. Pseudobulbs up to 7 cms. × 4 cms., leaves up to 19 cms. × 5 cms.

Cirrhopetalum

1. **C. fimbriatum,** Lindl. Locally common on rocks and branches of trees at 4,500-5,000 ft. Moskal, Devakeri, fl. April and May, caps. June. 1911-12, 1925-6.

Scape purplish with two scarious bracts. Lateral sepals dark crimson to liver-coloured; dorsal sepal and petals similar in colour but fimbriations yellowish or greenish. Lip concave or longly boat-shaped, almost black on the margin, becoming pale greenish near the centre. The lateral sepals of older flowers may be dull yellowish flushed with dark crimson by bleaching.

2. **C. Gamblei,** Hook. f. Common on shaded tree trunks at 4,-5,000 ft. Moskal, At., Dup., fl. May and June. 1934-5, 1936-7. Some plants have the sepals, petals and lip all clear lemon yellow, others have the large lateral sepals yellow and the dorsal sepal and petals heavily streaked with brownish-crimson, and other plants have all the sepals and petals heavily marked with dull crimson. Pseudobulbs finely wrinkled, yellowish to dark green, glossy. Flowers have a carrion smell which suggests fly fertilisation.

3. **C. Proudlockii,** King and Pantl. Near Moskal, fl. June. 1993.

Chrysoglossum

1. **C. maculatum.** Hook. f. East ridge along streams in shola at 5,500 ft. Bel. fl. May and June. 2127, 2130, 2149. Grows in association with *Calanthe Masuca.* Sepals and lateral petals green spotted purple, lip white, mid-lobe acute with margins turned in, spotted purple, side-lobes erect, spotted purple, base of mid-lobe with a raised palate with 2 keels, narrowing and becoming 3-keeled below, claw auricled, mentum yellow, ovary green.

Eria

1. **E. baccata,** Lindl. Very common on branches of trees and rocks at 5,500-6,000 ft. on both ridges, fl. June. 1941.

2. **E. Dalzelli.** Lindl. At., fl. Aug.

3. **E. nana,** A. Rich.

4. **E. polystachya,** A. Rich. Frequent on tree trunks at about 5,500 ft. on both ridges, fl. Sept. 1891-2. Sepals and petals pale straw-coloured. Lip with deep yellow margin and 4 dark brown ridges on upper surface.

5. **E. pauciflora,** Wt. Frequent on tree trunks 5,000-5,500 ft. on both ridges, fl. Sept. 1914-5. Often grows in very large masses extending for several yards up the trunk or along the larger branches of trees. Sepals and petals pure white. Lip cream-coloured with a raised yellow Y on the upper surface.

Coelogyne

1. **C. odoratissima,** Lindl. Dup. Flowers not seen. Identified by its characteristic pseudobulb and leaves.

2. **C. nervosa,** A. Rich. Frequent on trees on both ridges at 5,000 ft. and above, fl. June-Sept. 1913.

Calanthe

C. Masuca, Lindl. Frequent in sholas at 5,000 ft. and above, fl. June-Sept. Scape and inflorescence up to 120 cms. long. Lip bright purple, petals and sepals white flushed with purple, calli on lip orange becoming reddish-purple.

Eulophia

1. **E. pratensis.** Lindl. Amongst grass at 5,000 ft., Dup., fl. June. 2174. Not common.

2. **E. nuda,** Lindl. In deciduous forest at 4,000-4,500 ft., fl. April and May. 1989. There appear to be two colour forms of this species : (1) corolla yellowish-green, sepals and, to less extent, petals marked purplish-brown on back, spur and lip yellowish-green, disc pale purple, only slightly tubercled on veins ; (2) sepals and backs of petals dull, dark purple, inner side of petals and disc of lip bright purple to pink, lower part of lip pale, spur more acute.

Cymbidium

. **C. aloifolium,** Sw. Eastern slopes 4,000-4,500 ft., June, caps. June. 2145, 2150. Sepals and petals cream-coloured with a brownish-red median stripe. Side lobes and apical part of mid-lobe of lip dark crimson, basal part pale yellow, whole surface velvety. Leaves thick, erect, bright green, glossy. Bracts at base of scape pale brown.

Geodorum

G. densiflorum, Sch. In evergreen forest 4,000-4,500 ft., Mal. Bedaguli, fl. June. 2154, 2197. Sepals and petals pale mauvish-pink, lip broadly boat-shaped, margin of lip purplish-pink, disc yellow, laminated.

Polystachya

P. purpurea, Wt. Frequent on trees and rocks 4,000-5,000 ft., fl. May and June.

Luisia

1. **L. teretifolia,** Gaud. Frequent on trees, E.sl., Pun. Gt. 4,000-4,500 ft., fl. and caps. June. Sepals and petals greenish-yellow; lip yellow heavily blotched dark purple, the side lobes and base becoming almost completely purple.

2. **L. tenuifolia,** Bl. E.sl. 4,500 ft., fl. June. 2144. Basal part of lip triangular, very dark crimson, glossy; apical part fiddle-shaped heavily mottled deep crimson on a whitish ground, velvety. Sepals and petals dull greenish-yellow, lateral sepals with pointed concave tips.

Rhynchostylis

R. latifolia, Fisch. ? Moskal, on trees 4,500 ft., fl. Oct., caps. Sept. 2151. Leaves 9.5×2.5 cms. oblong slightly unequal at tip, thick and fleshy, very slightly keeled. Spikes dense-flowered, flowers sessile, base of ovary in a pit in the spike, about 4 mm. long. Sepals ovate brownish-green on back, two lateral sepals keeled. Lateral petals pale green. Scrotum pale green, epichyle triangular with a large conical appendage on underside, white with crimson calli above and a pit between the calli.

Chilochista

C. pusilla, Sch. ? On small branches of trees and shrubs in shola and damp deciduous forest, 4,500-5,000 ft. Dup., Bedaguli, fl. April-May. 2162, 2176. At the beginning of the monsoon rains a few lanceolate leaves up to about 1 in. long develop.

Aerides

1. **A. cylindricum,** Lindl. Very frequent on trees At.- Bellaji 4,000-5,000 ft., fl. May. 2110. Mid-lobe of lip yellow blotched purple, side lobes white streaked purple. Sweet-scented. Transplanted to Tambaram, where it flowered Jan.

2. **A. ringens,** Fisch. Frequent, E. sl. on trees at 4,500-5,000 ft., fl. July. 2198. Flowers white.

Vanda

V. parviflora, Lind.? Dod. on trees, 4,000 ft., caps. May. 2146.

Saccolabium

1. **S. Jerdonianum,** Reichb. Evergreen forest below Honnametti on trees, fl. Sept., caps. June. 1894-6, 1966. Bracts not longer than pedicel and ovary, spur often as long as the lateral sepals.

2. **S. pulchellum,** Fisch. Frequent Moskal-Bedaguli on trees, fl. May-Sept. 1938. Transplanted and grown at Tambaram, fl. Dec. Sepals and petals green outside, inside pale green heavily mottled brownish-crimson lip white with a yellow centre, mentum whitish with pale reddish markings. Column reddish brown, ovary pale green.

S. sp. nov. East ridge at 5,500 ft. on trees in shola, fl. Sept., caps. Dec. 1889, 1890.

Diplocentrum

D. recurvum, Lindl. Very frequent throughout the area at 4,000-5,000 ft. on trees, fl. May and June, caps. Dec. 1933.

Aneochtochilus elatior, Lindl. Frequent in sholas on the east ridge at 5,000 ft., fl. Dec. 2071. Sepals olive green on back, whitish within, becoming brownish near tip. Petals and lip pure white. Spur white-streaked green. Ovary olive green and brownish.

Zeuxine

Z. longilabris, Benth. Near Bedaguli in deciduous forest. Open flowers not seen.

Nervilia

1. **N. biflora,** Schltr. Near Cubbongundi in bare patches amongst tall grass in open deciduous forest 4,500 ft., fl. May. 2112. Scape and sheaths purplish-brown. Sepals and petals pale cinnamon. Lip almost white below, heavily veined with purple above, mid-lobe folded along a median line so as to form a keel on the upper surface. Sepals and petals fully expanded during the day, folded round the lip at night. Sweet-scented. The leaf appears a month or so after flowering. Upper surface of leaf yellowish-green mottled with bright green and brownish-red in the hollows to uniformally dull dark purple, under-surface purplish. Two reddish ovate cataphyls at the base of the very short stem. Tuber white.

2. **N. Aragoana,** Gaud. Frequent at 4,000-4,500 ft. in deciduous forest. Mal., Minchiguli, fl. April and May. Leaves June and later. 1932, 2113, 2115. Scape and bracts white to purplish. Sepals and petals greenish-yellow at base, side lobes whitish with dark purple veins, mid-lobe with longish white and purple hairs on upper surface. Ovary 6-keeled yellowish-green, keels purplish.

3. **N. monantha,** Blat. Frequent throughout the area from 4,000-5,700 ft. in open patches amongst tall grass in shola and moist deciduous forest, fl. May, caps. and leaves June and later. 1904-1905, 2114. Scape purple to brownish-green. Bracts pale. Sepals and petals pale green above, tinged with dull purplish-brown below. Lip whitish, fimbriations and hairs violet or purple. Cinnamon-scented.

Epipogum

E. nutans, Reichb. f. Dod,. Mal., 4,500 ft., fl. May. 1898, 2142.

Habenaria

1. **H. barbata,** Wt. E.sl. 4,000 ft., Moskal 4,500 ft., fl. Sept. 2199.

2. **H. digitata,** Lindl. var. **foliosa,** Hook. f. Amongst grass on both ridges at 5,000-5,500 ft., fl. June-Sept. 1878, 1907. Leaves pale green beneath. Lateral sepals quite white, dorsal sepal green. Petals and lip white near middle becoming green at tips. Has an unpleasant sour smell.

3. **H.** sp. nov. At. in evergreen forest, fl. July-Sept. 2194. Leaves very pale below almost white-glaucous, upper surface yellowish-green, margins finely waved, tip curled back.

4. **H. rariflora,** A. Rich. Frequent on rocks at 5,000-5,500 ft. and descending on the eastern slopes to about 4,000 ft., fl. Sept. 1908-1909. Plants from lower altitudes are larger and have much more fleshy leaves than those from higher elevations.

5. **H. plantaginea,** Lindl. Pun. Gt. 4,000 ft., E.sl. in bamboo thickness, 3,500-4,000 ft., fl. Sept. 1896.

6. **H. longicalcarata,** A. Rich. Common in grassland at 4,500 ft. and above, fl. Sept.

7. **H. Heyneana,** Lindl. Common in marshy places in grassland at 5,000 ft. and upwards, fl. Sept. 1900-1901. The lateral petals and lip are quite white; lip and petals turn yellow before fading and whole flower dries blackish.

8. **H. affinis,** Wt. Locally common in tall grass in open forest, Moskal, Mal., fl. Sept. 1916-17, 1922-3. Dorsal sepal grass-green, rest of flower light yellowish-green. Flowers slightly fragrant.

9. **H. ovalifolia,** Wt. E.sl. in deciduous forest, 4,000 ft., Mal. 4,500 ft., fl. Sept. 2183.

10. **H. Perrottetiana,** A. Rich. Very frequent in grassland at 5,000 ft. and above, Dup., fl. Sept. 1899. Sepals green; petals and lip yellow, column whitish-green.

Peristylus

1. **P. spiralis,** A. Rich. Very frequent in wet places in grassland at 5,000 ft. and above, fl. Sept. 1910.

2. **P. aristatus,** Lindl. In evergreen forest at 5,000 ft. At., fl. Sept. 1893.

3. **P. Stocksii,** Krzl. Sholas At., fl. Sept. Whole flower green, spur paler. No scent noticed.

4. **P. goodyeroides,** Lindl. In deciduous forest at 4,000 ft., E. sl., Mal., fl. Sept. 1903. Sepals yellowish-green; petals and lip white; spur yellowish; ovary pinkish-brown. Cinnamon-scented.

Plantathera

P. Susannæ, Lindl. Frequent in tall grass. At., Dup., Mal., fl. Sept.

Satyrium

S. nepalense, Don. Pink-flowered form frequent in grassland at 5,000 ft. and above, fl. Sept.

Disperis

D. neilgherrensis, Wt. Very frequent in deciduous forest and tall grass at 4,000 ft. and above. Dod., Mal., E.sl., fl. May and June. 1879. Lateral sepals mauvish-pink; petals and dorsal sepal deep pink becoming brownish, veined purplish.

Zingiberaceae

Globba bulbifera, Roxb. Common in undergrowth in moist deciduous and evergreen forest, 4,000-4,500 ft., Mal., Bedaguli, Bel. E.sl., fl. Sept. 2200.

Curcuma

1. **C. neilgherrensis,** Wt. Very common in grassland above about 4,500 ft. fl. May. 1885.

2. **C. pseudomontana,** Grah. Evergreen forest, 4,000-4,500 ft., Bedaguli, fl. May. Only overed flowers seen.

Hedychium coronarium, Koen. In marshes at about 4,500 ft., Mal., Bedaguli, fl. June, caps. Sept. Most plants are white-flowered and have villous calyces, but the yellow-flowered form also occurs. 1886-7.

Zingiber

1. **Z. Zerumbet,** Sm. In deciduous forest at 4,500 ft., Minchiguli Valley, caps. Sept.

2. **Z. officinalis,** Roec. Deciduous forest, apparently wild. Dod. Flowers not seen.

3. **Z. Cassumunar,** Roxb. Frequent amongst tall grass at 4,500-5,000 ft., fl. June, caps. Sept. 1882.

Costus speciosus, Sm. Mal. in moist forest. Flowers not seen.

Elettaria Cardamomum Maton. Cultivated in evergreen forest and may also be wild.

Musaceae

Musa superba, Roxb. On rocky slopes near Bedaguli. Leaf with about 80 pairs of prominent veins, midrib channeled above, rounded and red below, oily.

Haemodoraceae

Ophiopogon intermedius, Don. Very common in sholas and evergreen forest, 4,500 ft. and above, fl. June-Sept. 1942.

Iridaceae

Belamcanda chinensis, Lehm. (K) Devakeri, fl. Sept. A not very common plant from the Far East that has run wild.

Amaryllidaceae

Hypoxis aurea, Lour. Frequent on grassy slopes at 5,000 ft. and above, fl. and caps. May. 2201-2.

Curculigo orchioides, Gaertn. Common throughout the area, fl. June-Sept.

Crinum latifolium, Linn. Amongst rocks, E.sl. 4,500 ft., fl. April. 2141.

Pancratium parvum, Dalz. Common on grassy hilltops of the eastern ridge 5,000-6,000 ft. and extending down the Punjur Ghat to 3,500 ft., fl. April, caps. May. 1974, 2072, 2124-5.

This plant is leafless when in flower, the leaves appearing a little later and persisting during the moister months. Only one peduncle is produced by each bulb in a season, and there are 2-4 flowers to a peduncle. The flowers open in the late afternoon and wither next morning. This nocturnal flowering and the long slender corolla tube (up to 10 cms. long) suggest pollination by moths. Usually the flowers on the same plant open singly on successive days but sometimes two flowers on the same peduncle open together. The flowers are dimorphic; in some the style is short, the stigma being near the base of the staminal column; in others the style is long and extends up to 2 cms. above the mouth of the staminal column. Each plant has flowers of one form only. Plants at lower elevations have much longer and stouter peduncles than those on the hilltops.

Dioscoreaceae

Dioscorea

1. **D. bulbifera,** Linn. Common, Mal., Pun. Gt., 4,000-4,500 ft., fl. Sept. Female plants much more robust. Bulbils in axils large, leaf cordate, perianth lobes pinkish. In this genus the direction of twining is regarded as a constant character. This species normally twines to the left. At least one specimen collected by the writer was twining to the right.

2. **D. tomentosa,** Pun. Gt., 3,500 ft., E.sl. 4,000 ft., fl. June.

3. **D. pentaphylla,** Linn. E.sl. 4,000-4,500 ft., caps. Sept.

4. **D. oppositifolia,** Linn. Common, deciduous and evergreen forest, 4,000-5,000 ft. New leaves end of April.

Liliaceae

Asparagus

1. **A. racemosus,** Willd. Mal., E.sl., Bedaguli, fl. May.

2. **A. gonoclados,** Bakers. At., fl. May.

Smilax

1. **S. aspera,** Linn. Common, Mal., Pun. Gt., 4,000-4,500 ft., fl. June-Sept.

2. **S. prolifera,** Roxb. Near Moskal, fl. Dec.

Gloriosa superba, Linn. Common, Mal., Pun. Gt., 4,-4,500 ft., fl. June-Sept.

Dracæna terniflora, Roxb. In evergreen forest at 4,000 ft. Dod., fl. and berries May.

Lilium neelgherrense, Wt. Growing in striking profusion amongst tall grass on the western slopes at 4,000-5,000 ft. Also in grassland on the eastern ridge at 5,000 ft. Fl. Sept., caps. shedding May.

Chlorophytum

1. **C. malabaricum,** Baker. Moist deciduous forest Pun. Gt. 3,500-4,000 ft. fl. May-Sept. Not typical. Leaves falcate, 1.5 ins. wide, glaucous. Anthers and filaments about equally long. Perianth lobes 5-nerved, ·33 in. long.

2. **C. laxum**, R.Br. Common, grassy slopes and hilltops, 4,500-5,000 ft. fl. May. 1921.

Scilla indica, Baker. E.sl., Pun. Gt. 4,500 ft., fl. May.

Iphigenia indica, Kunth. Frequent throughout the area 4,000-6,000 ft., fl. June.

Pontederiaceae

Monochoria vaginalis, Presl. var. **plantaginea**, Solms.-Laub. Devakeri, 5,000 ft., fl. June-Sept. 2143.

Commelinaceae

Commelina

1. **C. clavata**, Clarke. Very common along streams and in moist places in grassland at 5,000 ft. and above. Fl. May, Sept., Dec. 2134.

2. **C. attenuata**, Koen. 4,000-4,500 ft., fl. Sept.

3. **C. benghalensis**, Linn. E.sl. 4,500 ft. and below, fl. Sept.

4. **C. obliqua**, Ham.) In swamps in evergreen forest at 4,500 ft., fl. Dec. 1975, 2067. Leaves up to 6 cms. wide. Seeds oblong, surface smooth, black with grey crusty patches.

5. **C. undulata**, R.Br. var. **setosa** Clarke. E.sl., 4,000 ft. and below in rock crevices, fl. May.

6. **C. Kurzii**, Clarke. Very common amongst grass and in thickets at 4,000-5,000 ft., fl. May, Sept., Dec. Plants at lower levels semi-erect and about 2 ft. high.

7. **C. indehiscens**, Barnes. In swamps in evergreen forest, 4,000 ft., Minchiguli Valley, Bedaguli, fl. and caps. June. Resembles *C. benghalensis* but produces cleistogamous flowers and underground capsules.

Aneilema

1. **A. dimorphum**, Dalz. Amongst grass 4,500-5,000 ft., and caps. Sept. 3 stamens with filaments bearded about the middle, anthers dark purple with line between the cells; 3 staminodes with cream-coloured 3-knobbed anthers and light purple practically unbearded filaments. 3 petals mauve, 3 sepals brownish purple.

2. **A. spiratum**, R.Br. Pun. Gt.

3. **A. sinicum**, Lindl. Common in grassland at 5,000 ft. Fl. May, Sept.

4. **A. giganteum**, R Br. Mal. amongst tall grass in moist deciduous forest at 4,500 ft., fl. and caps. Sept. 1947-8.

5. **A. paniculatum**, Wall. Common amongst moss in hollows in rocks, usually on hilltops, 5,000-6,000 ft., fl. Sept. 1946. Plants not exceeding 5 cms. high. Sepals red, petals mauvish-blue. Filaments naked. Anthers dark red with black margins. Staminodes with white 3-knobbed heads. Pollen cream-coloured.

6. **A. montanum**, Wt. In swamps and along streams in evergreen forest at 4,500 ft., fl. May, June, Sept.

7. **A. ovalifolium**, Hook. f. Dod., fl. May.

Cyanotis

1. **C. cristata**, Schult. f. 4,000-5,500 ft., fl. Sept.

2. **C. tuberosa**, Schult. f. Very common amongst grass 4,500 ft. upwards, fl. April, Dec. 2205. At 4,500 ft. in tall grass it attains a height of about 3 ft.

3. **C. villosa**, Schult. f. Common in evergreen forests and shola 4,500 ft. upwards, fl. June, Sept.

4. **C. arachnoidea**, Clarke. Common between rocks and in grassland on hilltops 5,000-6,000 ft., fl. June, Sept. 1943. Leaves red, short and blunt at tip.

5. **C. fasciculata**, Schult. f. Between rocks at 5,000 ft., fl. Sept.

Juncaceae

Juncus prismatocarpus, R.Br. Devakeri, 5,000 ft., fl. May.

Palmaceae

Phœnix humilis, Royle, var. **pedunculata**, Becc. Common in grasslands up to 5,000 ft., fruiting May.

Caryota urens, Linn. In shola forest at 5,000 ft. At.

Calamus Gamblei, Dec. Frequent in evergreen forest 4,000-5,000 ft. Dod., fl. and fr. May and June.

Pandanaceae

Pandanus tectorius, Soland. In swamps at 4,000-4,500 ft., unripe fruit June. Flower not seen.

Araceae

Lagenandra toxicaria, Dalz. var. **Barnesii**, Fisch. In streams and marshes in evergreen and deciduous forest 4,500 ft., Mal., near Bedaguli, fl. June. 1950, 1968. Sheaths with 2 keels. Chamber and base of limb whitish, upper part of limb dull pale greenish, tip dark brownish-green, inside limb pinkish with purple processes, inside of chamber dark purple with darker lines. Stigmas white dusted brick red.

Colocasia antiquorum, Schott. In swamps, Dod., Mal., E.sl., fl. June. Leaf blades up to 24×14.5 ins. Spathes 12 ins. long.

Remusatia vivipara, Schott. Frequent throughout the area above 4,000 ft. on rocks, in forks of trees and in the ground. Fl. about March.

Arisaema

1. **A. tortuosum**, Schott. Frequent throughout the area above 4,000 ft.

2. **A. Leschenaultii**, Bl. Frequent in sholas on the western ridge and in the Doddasampage evergreen forest at 4,500 ft. and above; less frequent on the eastern ridge.

3. **A. Barnesii**, Fisch. Same distribution as (2) and more common than it in the Doddasampagi Forest. 2139, 2140. The plants of this species growing round Bellaji have long, stipitate flat leaflets glossy below, long acuminate tips, numerous veins and a very clear intramarginal vein. Peduncle and petiole green with some dark purple mottling, cataphylls dark purplish green with some rather obscure scarlet mottling.

4. **A. peltatum**, Fisch. In sholas on the western ridge.

All the above plants flower in May and June and form ripe berries in Sept. and Oct.

Amorphophallus mysorensis, Fisch. and Bar. Bamboo forest, Pun. Gt. 3,500 ft., fl. April, berries ripen June. Peduncle 18 ins. long, mottled pale and olive green. Spathes purple, glossy. Lowest 1 in. of spadix with female flowers, ovaries spherical, yellowish green, stigma irregularly spherical a little smaller than ovaries, buff-yellow warty. One row of neuters consisting of rounded spongy bodies much larger than the ovaries. 2½ ins. of male flowers, anthers 4-celled opening longitudinally, corrugated and warty, tapering upwards.

Raphidophora pertusa, Schult. Climbing on large trees in evergreen forest, Moskal, fl. Oct.

Lemnaceae

Lemna polyrrhiza, Linn. Dod., in swamps.

Eriocaulaceae

Eriocaulon

1. **E. Thwaitesii**, Koern. At., fl. Sept.

2. **E. melaleucum**, Mart. At., fl. Sept.

3. **E. collinum**, Mart. ? Moskal, fl. June.

BIOLOGICAL NOTES ON *SINOXYLON SUDANICUM* LESNE AND ITS PARASITES IN S. INDIA.

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(*With two graphs.*)

INTRODUCTION.

In November 1935, in the course of an investigation into the possibilities of the biological control of *Pempheres affinis* Fst., the senior author had occasion to collect a few Bostrychid adults from tunnels especially bored into the stems of green cambodia cotton plants taken directly from the field. These were sent to the Imperial Institute of Entomology, London and were identified as *Sinoxylon sudanicum* Lesne. Little did the author suspect, at the time, that the insect would have such an intimate bearing on the problem in hand, as revealed by subsequent studies.

Bostrychids as a group appear to have attracted little attention in S. India in the field of Agricultural Entomology. They are known to be of great economic importance as borers of various kinds of wood. Apart from brief references to their biology and habits from time to time by Forest Entomologists, comparatively little is still known or has been published on the subject. Although special studies on this economic group would, therefore, be highly desirable, it has not been possible for the writer to do so. But some useful observations in the course of other studies have been made from time to time during the last four or five years on one of the economic species namely *Sinoxylon sudanicum* Lesne and it is the purpose of this paper to present a connected account of the same, so as to supplement what is already known of the species.

REVIEW OF PREVIOUS KNOWLEDGE

Sinoxylon sudanicum was first described by Lesne (1896) and further in 1906. In spite of its common occurrence in S. India, it seems that little is known of its biology or habits. The first record of the species in South India appears to be by Fletcher (1914) who says that its life history is not known. He suggests its probable occurrence in the whole of South India particularising Bellary, Coimbatore and Chingleput. According to him it attacks dry stems of Agathi, dead Cambodia stalks, and almost any dry soft wood. Gardner (1933) has described and figured the mature grub. The latest reference is by Beeson and Bhatia (1936) who record it as widely distributed in Bengal, Bihar, Bombay, Central Provinces, Madras, Mysore, Punjab, Sindh, United Provinces, and N. Africa. Their list of host plants includes *Acacia* sp., *Albizzia* sp., *Balanites roxburghii*, Bamboo, *Butea frondosa*, *Casuarina* sp., *Dalbergia* sp., *Ficus palmata*, *Mallotus* sp., *Mangifera* *indica*, *Pongamia glabra*, *Prosopis spicigera*, *Quercus* sp., *Rhus parviflora*, *Shorea robusta*, *Terminalia tomentosa*, and several unidentified woods. They also record that the emergence period is prolonged, 40% of the population emerging in May and 43% in April, June and July with a subsidiary peak at the end of July and they, in fact, make out mainly two broods in a year.

ECONOMIC STATUS OF THE SPECIES IN S. INDIA.

The discovery of this insect as a useful and abundant alternate host of an important Braconid parasite *Spathius critolaus* of the cotton stem weevil served to bring it into prominence in S. India. Its presence is a common phenomenon in the weakened or wilting green plants of cambodia. Almost every wilting plant in the field may show its tunnelling, and this becomes prominent in the season October to January when considerable numbers of cotton plants are killed or weakened by stem weevil attack. At the close of the cotton season, the cotton plants pulled out and stacked from April to August display heavy infestation which serves to bring about a continuity in breeding throughout the year. It may be evident, therefore, that the conditions of cambodia cultivation provide exceptionally favourable facilities for breeding and multiplication. It is no wonder, then, that the insect, in virtue of its habits and abundance, constitutes an excellent alternate host for an important stem weevil parasite.

Description. The adults are robust beetles of a deep brown to dark colour, varying in length from 3½ mm. to 5 mm. As is the case with most bostrychids the body is of a cylindrical form.

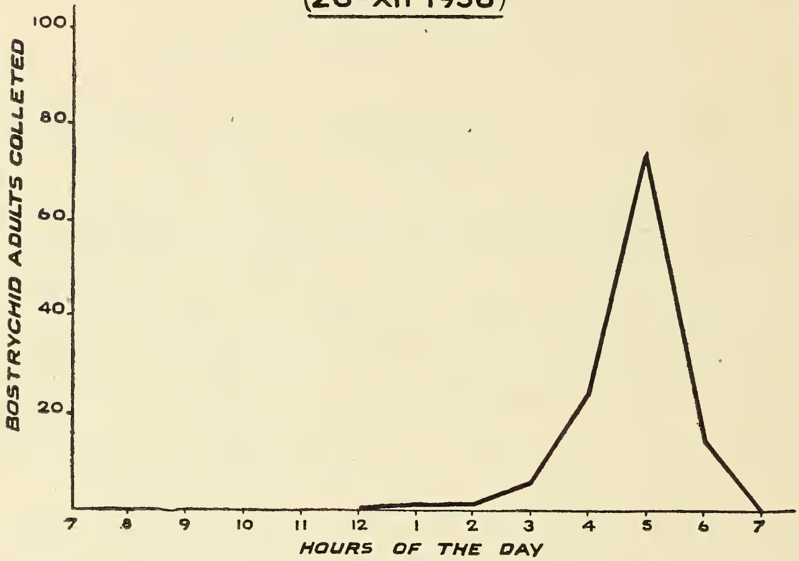
The sexes are so similar that it is very difficult to distinguish the males from the females except by the smaller size of the former. The only character by which these may be distinguished lies in the comparative length of the silky bands on the internal aspect of the posterior tarsi. These hairs appear to be somewhat longer in the male than in the female.

Numerous counts of daily collections have been made to ascertain the proportion of the sexes, and it has been observed that the females invariably outnumber the males.

ACTIVITY.

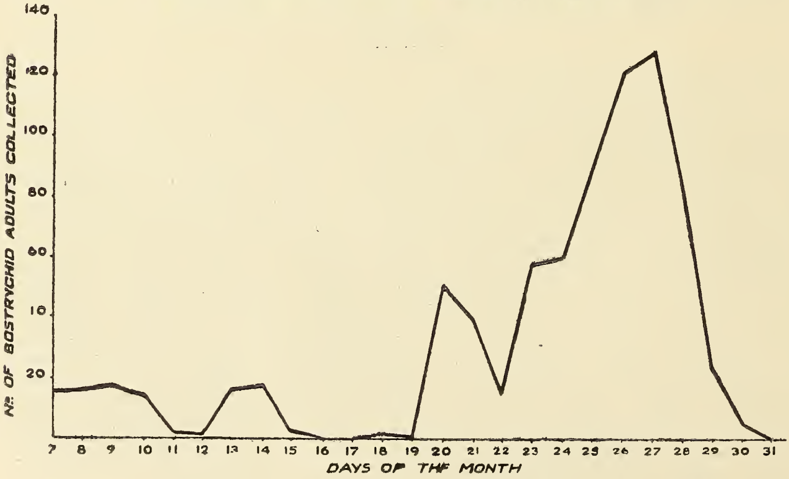
The beetles do not appear to be active within the cages but for the incessant and untiring tunnelling of the stalks. On sunny warm days, particularly late in the afternoon the adults can be seen flying from a distance and dashing against large wire gauze out-door cages filled with cotton stalks. Their activity appears to be governed by temperature and sunlight. They seem to possess great powers of flight although they seldom take to their wings even when exposed indoors, but have often been seen to crawl from stalk to stalk. Their powers of flight are of great importance for dispersal and spread of infestation. Their activities are best observed near large out-door wire gauze cages containing cambodia cotton stalks. They are seen flying from afar and fluttering about the cages. After dashing against the cages they can often be seen rolling on the ground beside the cages. Detailed observations have been made continuously for several months to determine the time of their greatest activity. Records of daily collections in relation to the prevailing weather conditions have been maintained for the months of June-July 1936, September-October 1936, December 1936 and January 1937 (vide table and curve appended) which will afford an insight into their behaviour during different hours of the day.

The hours of greatest activity as seen from the maximum hourly catches appear to be between 4 and 5 p.m. in the evening. The adults are seldom seen in the forenoon or after 7 p.m. Their activity commences by about 2 p.m. and attains the maximum by about 5 p.m. after which a definite decline can be noted. Bright sunshine seems to be an important factor inducing flight and activity. The catches during dull weather have been extremely poor. The adults boring into stalks inside cages also display the same tendency on bright sunny days; the adults may be seen resting inside on the sides of the wire gauze cage facing the sun.



BOSTRYCHID EMERGENCE DURING DIFFERENT HOURS OF THE DAY (26-XII-1936)

The daily collections made in December and January are depicted in the form of a curve.



BOSTRYCHID INCIDENCE IN 1936 DEC.

It may be seen that there are two peaks comparatively well marked, one of which is about the 19th and the other about the 27th of December. The adults commenced to appear in larger numbers towards the end of the month; out of about 788 collected more than 500 were obtained during the last week of the month. In January there was a distinct fall in the collections as seen from the figure 314 for the whole month with a maximum of 38 per day as against 128 of the previous month.

NUMBER OF GENERATIONS.

Beeson and Bhatia (1937) have recorded only two broods in the year under North Indian conditions. Systematic observations for nearly four years have revealed the occurrence of four distinct broods under South Indian conditions. As judged from the length of life cycle under these conditions it is possible to have even five generations per year. The biggest is obtained in September-October when large quantities of pulled out cotton stalks of the previous season are available for breeding. Another generation which ranks second in magnitude occurs in December-January when plenty of suitable breeding material may be available in the shape of wilting cambodia plants. Others have been recorded in April-May and in July-August when systematic collections of adult beetles have been made.

CONGENIAL CONDITIONS FOR ATTACK.

It has been observed that normal cambodia plants in a vigorous state of growth are not suitable as hosts of Sinoxylon. The other extreme of unsuitability is reached in the case of plants completely dead and dried up which are also equally unattractive to the insects. Between these two extremes there is a wide range of conditions under which the host is suitable for successful attack. A number of trials to test the conditions of suitability was carried out. Two lots of cambodia plants—one consisting of 100 plants and another of 50 plants—pulled out from the field were exposed in the open near the cages on 7th December 1936 for attracting the beetles. On the third day of exposure the first attack by the beetle was observed and the material continued to be attacked for about 23 days, i.e. till the 28th of the month. No fresh attacks were observed after that date, though the observations were continued up to the 1st January of the next year.

Another lot of 82 uninfested plants pulled out on the 25th of November, was exposed on the 5th of December. The attack was observed on the 7th and it continued up to the 10th with no further attacks after that date. Several other lots of plants in different stages of wilting were also experimented with and the results were in conformity with previous observations. In one lot of plants with the bark peeled off, the infestations were not as numerous as in others. It will be seen from these trials that while certain conditions, particularly moisture contents, render plants suitable, no pathological conditions are needed to make the plants attractive.

NUMBER AND NATURE OF THE ATTACKS.

Detailed observations were made regarding the nature of infestations in a collection of 91 attacked plants. In 76 cases the entry was through nodes, in 7 cases the tunnelling was a little away from the nodes, and in 8 cases the entry was effected on or about the hypocotyl region. In some cases the beetle prefers to attack the cut ends of stalks. The insect also bores into leading side branches of plants. Regarding the number of attacks, out of 93 plants examined, 86 showed single attacks, the remainder having double attacks. In all cases of double attacks the tunnels were seen bored near each other indicating that males of the species make separate entrance holes only occasionally.

THE COURSE OF TUNNELLING.

The female beetle commences its operations by gnawing a neat circular aperture often through the bark or rarely at cut ends, and throws out heaps of saw dust. The tunnel may be at a varying angle from the surface. This entrance tunnel descends deep into the stem and enlarges into a neat roomy chamber known as the pairing chamber from which two or three narrower tunnels branch off generally encircling the stem the outer surfaces of which are covered only by the thin bark. Slight deviations from this typical example have been encountered and these are illustrated in the figures attached. The male either utilises the same entrance aperture or constructs another close to it and communicating with the same. Not infrequently two females or even three have been observed in the pairing chamber. A bit of stem with one entrance aperture, a pairing chamber and two egg tunnels when examined revealed one dozen newly formed adults, six pupae, two full-grown larvae, six shrivelled up and dead larvae.

LIFE HISTORY.

Accurate determination of the life cycle with the rate of growth and duration of the several stages is extremely difficult in the case of these wood borers and therefore only approximate estimates of the same have been attempted.

IMMATURE STAGES.

Copulation has been noted on several occasions and has been seen to occur repeatedly, the process lasting roughly for a minute. Oviposition has not been observed nor has any estimate of the egg capacity been made. The female after eating out an egg tunnel round the stem, deposits its eggs at the bottom of the tunnel. Fertilised females caged with uninfested cotton stalks on 7-9-36 were examined on 17-9-36 and early stage grubs of approximately one or two days growth were observed in larval galleries. The construction of the egg chamber roughly occupies three to four days.

The grubs on hatching feed entirely on the wood and eat out larval galleries along the long axis of the stems. These galleries are filled with wood dust and excreta and the grubs themselves are seen buried in the dust. The egg and larval periods were roughly determined from data obtained as follows:—Fresh cotton stalks were caged with mated females and the material was examined at intervals to note the development of the grubs. The average period occupied varied between 30 and 32 days. The white curved grubs are somewhat active in their movements and go into pupation in a slightly enlarged neat chamber.

The pupa is white in colour and has a similar shape as the adult. The duration of the pupal stage was determined by the isolation of mature pupating grubs. The period occupies roughly 13 to 14 days.

LIFE CYCLE.

The data on entire life cycle are presented in the table below. Copulating pairs of adults were introduced into cages containing wilting cotton stalks and the first appearance of adults was recorded.

Adults introduced in cage on	Fresh adult obtained on	Life cycle in days
19-6-1936	8-8-1936	48 days
18-6-1936	8-8-1936	49 ,,
19-6-1936	10-8-1936	52 ,,
15-6-1936	27-7-1936	42 ,,
7-7-1936	21-8-1936	45 ,,
9-7-1936	1-9-1936	53 ,,
23-7-1936	9-9-1936	47 ,,

The life cycle period averaged about 48 days. The longevity of adults was tested by means of a few trials and this ranged from 4 to 23 days averaging 12.6 days.

HOST PLANTS.

With a view to test the comparative attraction exercised by different host plants a series of experiments was carried out. Stalks of other species of plants such as Acacia, Agathi and Mango were presented along with those of cotton in cages having Bostrychid adults. Among 30 stalks of Acacia only eight showed attacks. The adults apparently find it more difficult to tunnel into these than in cotton and do not traverse to any distance beyond their own body length. Agathi stalks supplied were left entirely untouched. Other trials where Agathi stalks alone were presented to the beetles yielded the same results. Mango stems showed better results in that three stalks out of 30 exposed displayed attacks. The beetles in this case seem to tunnel with greater ease than in Acacia. The adults appear to live for about a month when left with mango or cholam stalks. The striking preference to cambodia cotton shown by these insects was also apparent from various observations made in outdoor cages, wherein various other plants such as *Urena lobata*, country cottons, Bamboo, Triumfetta plants, several species of Sida and Hibiscus were kept on several occasions, the beetles were never observed to be attracted to such cages but were found fluttering about or resting on the cambodia cotton cage alone.

PARASITES.

Pediculoides ventricosus Newpt. :—This globular mite was a regular source of trouble in laboratory cages. These often suddenly appeared and devoured the immature stages of the beetles together with any parasite larvae attacking them.

Spathius critolaus Nixon :—This Braconid which is an important parasite of the grubs of the cotton stem weevil finds an excellent alternate host in these Bostrychids. The parasites confine their attentions to the advanced grubs of Sinoxylon. They attack mature grubs, also medium-sized grubs. Generally one egg, sometimes two eggs are placed externally on the grubs after their complete paralysation. The larva that hatches feeds, grows and consumes the entire contents of the host before cocooning in the host tunnel. The life cycle varies from 13 to 24 days. The males have a shorter life cycle than the females. The Bostrychid was, therefore, utilised as an alternate host for mass breeding of these parasites and five to six thousand parasites have been bred in the course of four years.

Various other species of parasites of the genus *Spathius*, particularly *Spathius* sp. near *labdacus*, and three undetermined chalcidoids have been observed to be parasitic on this host.

ACKNOWLEDGEMENTS.

The writer wishes to record his thanks to the assistants and fieldmen of the scheme who have all contributed to the collection of data presented in the paper. Particular mention has to be made of Mr. V. Margabandhu, who has taken great pains in making hourly collections during December 1936 and January 1937. The writer wishes to record his gratitude to the Indian Central Cotton Committee for making these studies possible by financing the Scheme and to the Government Entomologist and Cotton Specialist for affording facilities.

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OBITUARY

LT.-COL. A. H. MOSSE.

It is with regret that we record the death of Lt.-Col. Arthur Henry Eyre Mosse, C.I.E., of 45, Birling Road, Tunbridge Wells, which occurred on Wednesday week at the age of 65. Since he came to reside in the town on his retirement eleven years ago, Col. Mosse was a well-known personality, and when volunteers were asked for service in the A.R.P. early in 1938, he immediately put himself at the disposal of the authorities and became Head Warden of the South Group, a position he held until a few months ago, when he relinquished the work for health reasons. A very efficient officer, he was popular with everyone connected with the Group, and to mark their appreciation of his many valuable services, his colleagues made him a presentation on his retirement.

The fourth son of the late Deputy Surgeon-General Mosse, C.B., C.M.G., Lt.-Col. Mosse was educated at King's School, Canterbury, Bedford School and the Royal Military College, Sandhurst. He joined the Indian Army in 1897, and in the same year was attached to the Durham Light Infantry, and in the following year to the 104th Wellesley's Rifles. In 1901 he volunteered his services for famine relief in the Great Famine, and from that date he joined the Indian Political Service, serving in Aden and the Western Indian States as Political Agent. Towards the end of his service he was Vice-President of the Bhavanagar State Council during the minority, and in 1931 officiated as Agent to the Governor-General in the Western Indian States. During the Great War he served in Mesopotamia in the Judicial Department at Basrah, and was mentioned in dispatches. He retired in 1932 and was awarded the C.I.E. in the following year for his services as Vice-President of the Bhavanagar State Council.

On coming to reside in Tunbridge Wells, Lt.-Col. Mosse became District Head of the Soldiers', Sailors' and Airmen's Help Society. He was a Fellow of the Zoological Society and a member of the Bombay Natural History Society. While in India and Somaliland he was a big-game hunter. A great naturalist, he was especially interested in entomology. He published a book on his Somali experiences, and wrote many articles and short stories and was a frequent contributor to the *Journal of the Bombay Natural History Society*. Much sympathy has been extended to his widow, son and daughter in their bereavement.

Ex 'Times', 22nd April 1943.

MISCELLANEOUS NOTES

I.—OCCURRENCE OF THE LION IN PERSIA.

When I called to see you on my way through Bombay about a year ago, I mentioned that one of the surveyors working in S.-W. Persia recently had seen a lion. I promised to send you a few more details. Here they are:—

On 22nd May 1942 Jemadar Lal Khan, belonging to an Indian Field Survey Company engaged on survey work in S.-W. Persia, saw a lion about 40 miles north-west of Dizful. He had a squad of two signallers and four sepoys with him at the time and they all saw it. As the animal was only about 80 yards away I do not think that there was much chance of its identity being mistaken. In addition to his own men Jemadar Lal Khan had three local policemen with him belonging to the Persian gendarmerie.

The Jemadar described the lion as about 5 feet in length from the nose to the base of the tail, and greyish-yellow in colour. It had no mane. He reported that he 'shot at it but could not hit it'.

I think that it was near this place that the late Sir Arnold Wilson saw a lion a few years before the last war. I would be interested to hear whether any other lions have recently been reported from this area. So far as I know no others were seen by troops of the Persia-Iraq Force, up to the time of my leaving the Force last Spring.

Survey of India,
Murree.
December 30, 1943.

G. F. HEANEY,
Lt.-Col.

[It would appear that lions still occur in the wild and mountainous region around Dizful in South-west Persia. The last-reported occurrence from this area was that made by a party of American Engineers in 1930 and recorded in this *Journal* (Vol. xxxv, No. 3, p. 672).—Eds.]

II.—TIGER CLAW MARKS ON TREES.

With reference to the note on the above subject by Major R. C. Morris on page 656 of the *Journal*, Vol. xliii, No. 4, I wish to record that as Dunbar Brander has observed in his book, *The Wild Animals in Central India*, it is a habit of tigers to sharpen or clean their claws on trees. But Dunbar Brander qualifies this habit 'to be more an individual peculiarity constantly practised, rather than a general habit occasionally practised, as where the marks on trees are seen they are usually numerous and made by the same animal whereas miles of jungle containing tigers may be devoid of all signs of the habit'. I have very often observed the tigers kept in the zoo at Trivandrum, when let out from their cages into an adjoining spacious open-air arena (securely enclosed by high iron fencing) going straight for the trees therein and tearing the bark with their claws vertically downwards. The open-air enclosure has been so constructed as to correspond as much as possible to the natural habitats of the wild animals, with numerous trees at different stages of growth with an undergrowth of bushy shrubs and guinea grass, rockeries, caves and a watershed. The trees include *Eugenia javanica*, *Mangifera indica*, *Trewia nudiflora*, *Peltophorum ferrugineum*, *Swietienia macrophylla* and *S. mahogani*, all of which have the claw marks in abundance on them. The topmost mark on any tree is just over 8 feet from ground level. Unfortunately there is no Arjan (*Terminalia arjuna*). There is however a Rubber tree (*Castilloa elastica*) which is, but for one or two stray marks, invariably left alone. Plantain trees (*Musa* sp.) have been torn off and destroyed by these animals.

It might be mentioned in this connection that unlike lions, cats, or dogs, which have a habit of scratching the ground with their claws, the tigers seldom have been observed to make use of the ground for sharpening or cleaning claws. Tree-climbing among tigers might be individual peculiarities, for, even though many of the trees mentioned above have branches within easy reach below the 8 ft. height reached by the claws, none of them have been seen perched on any of the branches.

ZOOLOGICAL GARDENS,
TRIVANDRUM.
November 1, 1943.

E. S. SIMON.

III.—WILD DOGS ATTACKING A TIGER.

(Story told to me by Barkiya, shikari, and his brother and confirmed by the Range Officer.)

Soon after sunrise I spotted vultures circling in the distance, so my brother and I set off to invesigate.

After half an hour's brisk walking we arrived at Kapra Nala which at this point is about 30 feet wide and except for a small water hole, quite dry. The nala for the greater part of its course runs between very steep banks, but just here it opens out and its bed is level with the banks. On the opposite side of the nala and about 50 yards from it rise two hills about 200 to 300 feet high separated from each other by a very narrow ravine, full of long green grass and shaded by large trees—an ideal spot for a tiger to lie up after a hearty meal.

At the edge of the water hole we found traces of a recent tragedy—disturbed soil and blood stains. It was easy to read the story—a tiger had crouched in a patch of long grass and pounced on an unsuspecting sambhur when it came for a drink. Very cautiously, we followed the trail made by the tiger dragging the animal and eventually located the body in a clump of bamboo at the mouth of the ravine.

In the meantime the vultures had collected, but instead of settling round the carcass they alighted on the trees, an indication that the tiger was nearby.

My brother and I were arguing whether we should go back to the village and collect a few men to scare off the tiger so that we could collect what meat was left, when he drew my attention to a movement in the long grass half way up the hill on the right. We watched carefully and saw something red. My brother whispered to me *bakri* (barking deer), but I told him to be quiet and then we saw another and another and still another, until on that hill alone we counted 12. It then dawned to me that they were not *bakri* but wild dogs, and we decided that we better withdraw. To our horror we found a dog stationed alongside the path we had come by and then discovered that we were surrounded. We immediately climbed up a large fig tree and sat very quiet. We had never heard of wild dogs attacking men before, but we knew that if they treed any animal they would surround it for several days until hunger or weakness caused the animal to leave its shelter and then of course its fate was sealed.

From up the tree we had a very clear view of what happened. The dogs were stationed about 30 yards apart along both hills facing the ravine, as well as on the farther side of the nala. Altogether we counted 22 dogs. The strangest part about their behaviour was their absolute silence and when one moved, all moved, gradually closing in.

Suddenly with a snarl a tiger appeared and the dogs closed in still further until there was a ring of them round him, about 40-50 feet in diameter. They were apparently driving him into the bed of the nala where he could get no cover, but where their paws could get a firm footing, with no obstructions such as twigs or scrub. This was very evident from their action. When the tiger faced the way they wanted him to go, the line of dogs withdrew but closed in behind, but when he faced the opposite way, they stood up to him, bunching together and making stiff-legged rushes of a few feet.

The dogs however left a large *mahowa* tree out of their calculation, for when the tiger saw it he made for it with a rush scattering the dogs in his way. He gained the shelter of the tree and sat down with his back firmly against it and his tail curled round over his fore-paws. The dogs closed in round the tree until the nearest was within 10 feet; the majority crouched on their haunches with heads between fore-feet as if content to play a waiting-game. There were three or four half-grown pups which frisked round playing with each other.

For the first half hour the tiger sat quietly merely snarling occasionally, but then he began to lose his temper and gave vent to a couple of full-chested roars; but its only effect on the dogs was to make a few of them prick their ears.

The tiger then fell to lashing his tail, but one of the pups slipped round to the back of the tree and gave it a painful tweak. This brought the tiger round with a roar, he let loose with a 'hay-maker', the pup threw itself on its back, paws in the air, slipped between the tiger's legs and got away uncratched. This move left the tiger's flank and rear uncovered, and a full-grown dog leaped in from the left and snapped at the tiger's neck, just behind the ear, It was slow in its get-away with the result that it received a blow on the ribs which hurled it 10 feet away, stone dead.

The tiger sat down again, but presently the blood from the bite in its neck started to trickle down his chest. This made him very uncomfortable and when he could no longer endure it he lowered his head to lick the blood off. This momentary inattention cost him dear, as the instant his eyes were off them than the whole pack rushed in and a few hectic seconds followed; the tiger was completely hidden under a mass of snapping struggling dogs, they fastened on to him everywhere biting and tearing. It is impossible to give an accurate description of the struggle as all the eye could see was a seething mound of red, with glimpses of yellow and black. The dogs suddenly withdrew leaving five of their number dead or seriously injured. The tiger had fared very badly—one eye was closed, the corner of his mouth torn away, his ears in tatters and numerous gashes all over his body. The most serious injury seemed to be to his right fore-paw as he was unable to place it on the ground.

The dogs reformed their circle, but this time much closer; and whereas at first they waited for the tiger to make the first move they now started making tentative rushes and kept the tiger on the alert. This continued for nearly an hour and due to loss of blood the tiger was fast losing strength. Again the dogs rushed in and there was another confused struggle. When the dogs drew off this time the tiger was in very bad shape and it was with a great effort that he kept himself erect. Presently his head began to droop and again the dogs attacked, one fastened on to the tiger's throat and although immediately beaten to a pulp, its jaws remained locked and its hold could not be broken. In a supreme effort the tiger reared up on its hind legs with the dead dog still at its throat and others draped all over. Even with this glimpse we could clearly see that he had been disembowelled; he toppled over backwards and was immediately covered with dogs, there were a few more convulsive struggles and all was still.

At this stage my brother and I slipped down from the tree and went back to the village. We told our story and collected a crowd and returned to the scene of the fight. By the time we got there the dogs had gone, leaving the vultures in possession. All that was left of the tiger was bones, sinews and a few tufts of blood stained fur. We counted twelve dead dogs and could see where others had dragged themselves away.

A few years ago when there was a reward paid for wild dogs they were so rare that we did not see their foot-print for several years. Now the reward has been abolished and they have multiplied to such an extent that hardly a week goes by without our district being raided.

J. Connell & Co.,
Frere Road, Bombay. W. CONNELL.
October 15, 1943.

IV.—ELEPHANTS AT SALT-LICKS.

On one occasion I took two 'Koonkie' elephants to a salt-lick at the foot of the Aka-Dafla Hills on the north bank of the Brahmaputra River and they at once started to eat greedily of the grey earth, kicking great lumps out of the hill-side with their feet and putting them into their mouths. It was with the greatest difficulty that we could tear the elephants away from the spot. On another occasion my Government elephant refused to touch any of the earth at another lick at the foot of the Bhutan Hills. Why? It seems that elephants eat the earth only when they are so inclined or are in need of a purge.

There are two kinds of licks in Assam, one known as 'pungs' and the other as 'mati-kolais'. The former are found at the foot of hills, invariably where a land-slip has occurred and the weathered soil extends as a talus or cone-like, grey slope up to 100 feet or more. Water oozes out from the base and the place is obviously visited by all manner of animals, preference being shown for the freshly exposed surfaces higher up. 'Mati-kolais' are found on the plains, generally on the south bank, and resemble large white-ant hills, the sides and bases of which have been scraped away until a large shallow pit or hollow is formed in which water collects. Here the soil is much more clayey and yellow in colour, as compared to the grey, sandy earth of the 'pungs'. Some licks are more attractive to animals than others in the same neighbourhood, and the location of stockades for catching elephants depends on this fact.

TEZPUR, ASSAM. P. D. STRACEY,
October 6, 1943. I.F.S.

V.—ADDITIONAL NOTES ON THE BIRDS IN BETUL DISTRICT AND SURROUNDING AREAS IN THE CENTRAL PROVINCES.

I contributed a paper in Vol. xli, No. 2, of this *Journal* in 1939, and since then I have continued to keep notes about the movements of different species. As these notes have been continued for five years, they can be taken as a fairly reliable guide. I have extended the observations to the adjacent district of Amraoti (the Melghat), and the Hoshangabad District to the north. The information is both positive and negative, and will help to determine the limits of some species in Central India, of which the present records shew only a generalised distribution across India.

Sitta frontalis, the Velvet-fronted Nuthatch. Widely distributed but not common in the deciduous forest.

Pomatorhinus horsfieldii Sykes, the Deccan Scimitar Babbler. Also widely distributed in the forest. It was recorded in all months of the year, and is a resident species. It is usually found in pairs, and not in parties.

Chloropsis aurifrons, the Golden-fronted Chloropsis. Recorded once in Betul. Several birds were seen frequently in Chickalda (Melghat) in the hot weather of 1942.

Pycnonotidae Bulbuls. Only two species, *Molpastes cafer* Linn. and *Otocompsa jocosa* Linn. have been recorded in this part. *Molpastes leucogenys* has been recorded again from Nagpur by the Curator of the Museum. I mentioned it in my previous list, but I have not recorded it from any other locality yet.

Cercomela fusca Blyth, the Brown Rockchat. Quite common in Hoshangabad town on the banks of the Nerbudda. This is probably the southern limit of this species.

Cyanosylvia sueicica Linn., the Bluethroat. Not recorded in my previous list, but is quite common.

Kittacincla malabarica Scopoli, the Shama. Still not been recorded from these forests, but the Curator of the Nagpur Museum informs me that they obtained a pair in the Balaghat district.

Turdus simillimus Jerdon, the Nilgiri Blackbird. Discovered to be a migratory species. It arrives in the localities which it favours in April and leaves in October or November. It is confined to the higher elevations, and is quite settled in its habits seeming to occupy the same areas each year. The numbers seem to vary from year to year which is what one would expect in a migratory race. There are many interesting points to be settled. The birds appear in considerable numbers, and someone must lose their own birds; the race of these birds must be decided. Whether the birds reported from other localities in the Vindhyan hills and at Mount Abu are also migratory is to be recorded.

Monticola cinclorhyncha Vigors, the Blue-Headed Rock Thrush. I have recorded a single bird in March 1940. It is not a regular visitor to this part of India.

Eumiyas thalassima Swainson, the Verditer Flycatcher. A fairly common winter visitor to the higher parts of the Satpuras.

Terpsiphone paradisi Linn., the Paradise Flycatcher. Migratory as reported in my previous paper. The dates of the main occurrence are March-April to the rains. Some birds are seen in the rains, and an occasional bird in the cold weather. There are records of birds breeding in the hot weather, but whether all birds are breeding or some are passage migrants cannot be decided yet.

Hemipus picatus Blanf. and Oates, the Black-Backed Pied Shrike. This bird was seen in Chikalda in 1942 in the hot weather. I have seen individual birds once or twice each year. It may be said to occur regularly but is rare. I have seen it at all times of year, and it is a resident species.

Pericrocotus speciosus, the Scarlet Minivet. One of the most constant members of the forest community, while *P. peregrinus* is the species of roadside mango topes and groups of trees in cultivation. *P. erythropygius*, the White-bellied Minivet, is a less common species which is common in some years and rare or absent in others. *Lalage sykesi*, the Black-headed Cuckoo Shrike, is probably a summer visitor. The common and resident species is *Graucalis javensis*.

Artamus fuscus Vieillot, the Ashy Swallow Shrike. Has not been recorded again.

Oriolus oriolus, the Golden Oriole. A summer visitor to the Satpura hills, but I cannot say how far this migration extends. *O. xanthornis* is the common and resident species of the forest and hills.

Sturnidae. As I mentioned before, the distribution of the mynahs is local. *Acridotheres trisits*, the Common Mynah, and *Temenuchus pagodarum*, the Brahminy Mynah, are the common species. An occasional flock of the Rosy Pastor (*Pastor roseus*) are seen; and this year there were some flocks of the Grey-headed Mynah, *Sturnia malabarica*. The Jungle Mynah (*Aethiopar fuscus*) does not occur in these hill ranges.

In Hoshangabad I have found a few Pied Mynahs, *Sturnopastor contra*.

Ploceidae. *Stictospiza formosa* is the most interesting species of this group. I have seen this species only three times in five years, and each time to the west of the district near the Nimar border. It is evidently a very local species, and may be looked for in the Nimar and Khandesh areas. Of other species of this family *Uroloncha striata* is quite a common forest species. *U. punctulata* is also quite a frequent bird.

Gymnorhis xanthocollis Burton, the Yellow-throated Sparrow. Observed to be migratory. The general rule is for flocks of birds to appear in December-January. By February the birds are broken up into breeding pairs, though some small parties possibly non-breeding birds are still seen. The flocks re-assemble in May, and seem to disappear in early June-July. They are not seen commonly until December, but some flocks may be seen at times. The birds are present in very large numbers in the breeding season, and it is a genuine migration.

Emberiza melanocephala Scopoli, the Black-headed Bunting. A passage migrant in February-March. I have still failed to record it in any other month.

Motacillidae. *Motacilla alba* is the commonest of the migratory birds arriving early October and leaving in March When they first arrive they are in large numbers, but many pass on and they are then very wild, never still, and quite different from the staid individuals who settle down for the winter. *M. flava* appears more commonly in January-February. *M. cinerea* is a forest resident, and is usually found solitary even in the depths of the forest. It arrives the earliest mid-September, and leaves very late, mid-April to early May. This year I saw a few specimens of *M. citreola*, the Yellow-headed Wagtail, but it does not seem to be a regular migrant to this part of India.

Pitta brachyura Linn., the Common Pitta. One of our regular migratory species which nests in our forests. It arrives in late May and leaves towards the end of October.

Picus vittata, Vieill, the Little Scaly-bellied Green Woodpecker. Found to occur quite commonly in the forests. One other woodpecker also occurs, but I have still failed to identify it without doubt. It is probably *Chrysocolaptes festivus* Bodd., the Black-backed Woodpecker.

Merops orientalis Latham, the Green Bee-eater. A true local migrant, deserting the Betul plateau from July to September. The dates were regular each year and even in 1941 when we had poor rains the birds remained absent. The extent of this migration is not determined yet. *M. superciliosus*, the Blue-tailed Bee-eater, did not occur in Betul, but occurs in Hoshangabad.

Hemiprocne coronata Tickell, the Crested Swift. A very common species of the forests.

Cuculidae. The extent to which cuckoos are migratory is not worked out fully yet. The Hawk-Cuckoo is definitely resident in this part of the Central Provinces. The Pied Crested Cuckoo is equally certainly migratory; the birds arrive about the middle of June or the break of the rains. They leave in September, but young birds may be seen later. The Koel, I consider almost certainly to be migratory but there may be localities where they stay throughout the year. The Koel has been noted as early as the first week in March, but not later than the end of September. The Cuckoo, *Cuculus canorus*, arrives according to my observations at the beginning of May and has not been noted later than the middle of September. They are most common in June and July. *Cuculus micropterus*, the Indian Cuckoo, is more a forest species. The bird occurs most commonly in May and June. The status of this species is more difficult to determine, as the bird is smaller and is inconspicuous, and keeps to the crowns of trees and is rarely seen. I have only noted it in the period May to September, and then chiefly on the strength of the call. One other cuckoo is found, and this is almost entirely a bird of the forest as far as my observations extend; this is the Indian Plaintive Cuckoo, *Cacomantis merulinus*. I have noted it only in the rains, June and July.

In Betul District water birds are uncommon, but this summer being transferred to Hoshangabad on the Nerbudda I found a large community on the sandbanks of the river. Most of the birds had finished breeding by the beginning of June. The species found were Terns, *Sterna aurantia* Gray, the River Tern, *Sterna melanogaster* Temmink, the Black-bellied Tern and *Sterna albifrons*, the Little Tern; the Indian Pratincole, *Glareola lactea*, Temminck; the Ring Plover, *Charadrius dubius* Scopoli; the Spur-winged Plover, *Hoplopterus duvaucellii*; several other species came to feed but were not resident, such as storks, egrets, ibis; rather unusual were a large colony of sarus cranes which fed for the most part on the bare wheat and gram fields, and on the edge of the river. These birds all disappeared on the break of the rains.

HOSHANGABAD, C.P. C. HEWETSON,
November 11, 1943. I.F.S.

VI.—LATE BREEDING OF THE COMMON HOUSE CROW (*CORVUS SPLENDENS SPLENDENS*).

On the 6th October last my attention was drawn by the persistent cries of a house crow (*Corvus splendens splendens*) which were being responded to by what sounded like the raucous call of a young koel (*Eudynamis scolopaceus scolopaceus*). I spotted the two birds and found that my guess was correct. The next day I noticed the crow feeding the koel. It was fully fledged but the tell-tale brownish spots left no doubt about its age. It could have left the nest only recently. According to Stuart Baker, *C. splendens splendens* breeds in May, June and July in its north-western range (*Fauna of British India*, Birds, Vol. i, p. 33). It seems therefore unusual for a Delhi house crow to hatch a koel so late. I wonder whether the continuity of monsoon conditions has any thing to do with this late breeding. A pair of mynas (*Acridotheres tristis tristis*) have also hatched their young this year late in September in my bungalow. The chick left the nest on the 3rd October for the first time. But young mynas of the same age are found all over this place following the parents and clamouring to be fed.

IMPERIAL RECORD DEPARTMENT,
NEW DELHI. S. N. SEN.
October 13, 1943.

VII.—ON THE OCCURRENCE OF THE RUFOUS-BELLIED CRESTED TIT (*LOPHOPHANES RUBIDIVENTRIS*) IN THE SIMLA HILLS.

As the information regarding the distribution of this rare Tit in the *Fauna*, 2nd ed., Vol. i, p. 85, is extremely scanty it is worth recording that a specimen, 'one of a pair', was obtained by Mr. H. C. Smith, of the Burma Forest Service, on April 25, 1943, at Kalabagh, 11,000 ft. on the 'Chor' (sometimes spelt 'Chaur') mountain in Jubbal State. This is probably somewhat contiguous to the locality from which the Pinwill specimens, as cited in the *Fauna*, 2nd ed., came from.

Mr. Smith very kindly presented this specimen to me which is now in my collection.

SIMLA, 1943. A. E. JONES.

VIII.—FOOD OF THE WHITE-BREASTED KINGFISHER (*HALCYON SMYRNENSIS FUSCA*).

Writing of the habits of the Indian White-breasted Kingfisher (*Halcyon smyrnensis fusca*) Stuart Baker says: 'Its principal articles of diet are undoubtedly grasshoppers and locusts, but will eat almost any living thing not too large to swallow' (Birds, *Fauna of British India*, Vol. iv, p. 270). I hardly imagined that this kingfisher preyed upon small birds until I saw it actually seize and eat one (on December 6, 1943). I could not identify its victim, but it looked like a North Indian White-eye. The bird was still alive when the kingfisher carried it to its perch and a few knocks against the perching branch put a quietus to it. It seemed to be too large to be swallowed at a gulp and the kingfisher went on striking it continuously for twenty minutes or more in its characteristic manner. It would shift the body from the head to the tail before starting each fresh set of knocking. So far as I could observe, repeated knocking did not perceptibly reduce the size of the prey. Some of the contour feathers were of course dislodged but the tail and wing feathers were not affected. Most probably the meat and the bones lost their toughness before the body was finally swallowed head foremost. The tail feathers stuck out for a few seconds and the kingfisher flew to a neighbouring tree and began to sun itself without apparently feeling any need of a drink.

NEW DELHI. S. N. SEN,
December 7, 1943. *Keeper of the Imperial Records.*

IX.—GREEN PIGEONS IN SWAMP.

I read with interest Major Phythian-Adams' note on Green Pigeons in a Swamp. While passing through the Amring Forest Reserve on the banks of the Kopili River in Assam (Nowgong District) I came on a fairly large area of *lalang* grass and shrubs containing several pools to which elephants were frequent visitors. The soil was sandy and there were several bare patches of sandy clay and mud where barking deer, sambar, etc. had left many trails—in other words a sort of salt lick.

On trees around and in the area there were hundreds of Imperial pigeon, and many other kinds of pigeon and doves. From one of the sandy patches, a fairly damp spot, I flushed about a half a dozen green pigeon of some sort. I noticed it because I have never before seen a green pigeon on the ground except for the *Punai Tanah* of Malaya.

On my next visit at this place, with several guns, a green pigeon was shot on the ground at a water hole. Not knowing the Indian pigeons well, I could not identify it, but I noticed that it was slightly larger than the common green pigeon and that its feet and legs were bright yellow instead of red.

I saw no Imperial Pigeon (two kinds were shot) on the ground, but it was noticeable that were none to be found at other open grassy places in the area.

I note with interest also that green pigeon are not found in the coastal area referred to by Major Phythian-Adams. In Malaya I have shot many birds in mangrove swamps and on islets near the shore.

Post Box 10207, J. A. HISLOP,
Calcutta. *Capt.*
November 17, 1943.

X.—THE COMMON FLAMINGO (*PHOENICOPTERUS RUBER*): AN APPEAL

Surprisingly little is known and on record concerning the seasonal and local movements, breeding biology and life-history of this interesting bird in India. Its only known breeding grounds within our limits lie far out within the vast salt-encrusted expanses of the Great Rann, north of Kutch in Western India. Here the birds seem to breed erratically, apparently not more than about once in 3 years on an average. Their principal requirement seems to me that the nesting ground be covered by a shallow stretch of water at least during incubation and until the chicks are able to run about. In some years, at the appropriate season the water level is suitable and large concentrations of birds—7 to 8 thousand in 1943 according to one informant—collect on the area to build new nests or repair the old ones. The shifting movements of the surface water in the Great Rann are capricious and seem to be largely influenced by the direction and force of the prevailing winds. Thus it happens—apparently not infrequently—that even after the monsoon and other requisite conditions have been favourable, the water suddenly recedes from the proximity of the nest colonies or 'cities' leaving them high and dry. As soon as this occurs—apparently both while nesting has not yet commenced in earnest and even after incubation is well advanced and the eggs just hatched or hatching, the adult birds forsake the nest 'cities' and vanish from the neighbourhood more or less completely.

What we desire to learn is: Where do these birds go? Whether they shift elsewhere to breed? Whether when they first arrive at their nesting grounds they are physiologically ready for breeding? Whether being so they are capable of skipping a season or a number of seasons at will?

The undersigned would be grateful if members, and others interested and having the opportunity, will kindly communicate any observations they may make concerning the comings and goings of flamingoes in their area, giving season, date and the approximate numbers seen from time to time. Also any other general information they may be able to obtain regarding food, habits or behaviour.

In the interest of scientific accuracy it would be desirable for them to state whether their information is based on personal observation, surmise, local testimony or hearsay evidence, as the case may be.

33, Pali Hill,
Bandra (Bombay Suburban Dist.). SALIM ALI.
December 11, 1943.

XI.—NOTES ON THE EVENING FLIGHT OF GEESE AND DUCK.

At a certain fixed time before or after sunset wild fowl on a day sanctuary suddenly get off the water and fly round and round. Geese and duck may do this at the same time or at different times.

If there are no night feeding grounds attached to the sanctuary birds settle down after the evening 'roll call' as it were.

If there are night feeding grounds birds go to them either direct from 'roll call' or after an interval if they are apt to be disturbed on their feeding grounds.

The arrival at night feeding grounds is governed by the extent to which they are disturbed thereon.

Disturbance, to affect birds, has to be deliberate in the shape of shooting, netting or hawking or possibly the presence of human beings or cattle. Birds do not object to ordinary traffic in the proximity of dwellings if they are not deliberately interfered with. In Persia I have seen duck remain on water in barrow pits along the railway while trains go past. At Hygam Jheel in Kashmir duck stay all day within 20 yards of the bund and villages on the bund regardless of constant traffic: they are teal, shoveller, a few mallard, and odd pochard. I have never seen gadwall or pintail there.

Night feeding grounds are reconnoitered especially by geese and occupied if free. Shooting or even the presence of anyone on a feeding ground if persisted in makes duck leave it. Birds are very sensitive to regular disturbance but adjust their arrival to overcome it if the ground has any particular attraction. In a dak jungle near Dahbita, about 30 miles from Delhi, there is a shallow rectangle of clear water of about 5 acres literally teeming with snails. Duck and geese are always found there; and no matter when you shoot it up, you will find them back again inside half an hour.

Duck and geese leave their day sanctuary by the same route and with the punctuality of the B.B.C. news bulletins. No amount of shooting on the edges of the day sanctuary affects the time or the route of flight, but birds go over higher to avoid being shot up.

The brighter the moon the higher the flight. In snow, rain or fog, some, but not all, birds flight low.

The majority of the teal flight only a few feet above the ground preferring avenues along streams or over ground clear of trees. It has been noticed that teal crossing from Spain to Africa in a storm fly within a few feet of the waves going right down into the trough and, as it were, riding the crests.

Snow or the freezing of still water upsets and, in fact, misses the flight programme of many birds on a sanctuary, but there are some which do not change their daily flight routine. When a noise takes place you get two-way traffic instead of one way owing to the change not being adopted by all—the hour of flight is generally kept the same. Heron are even more punctual and regular in their flighting than duck and geese.

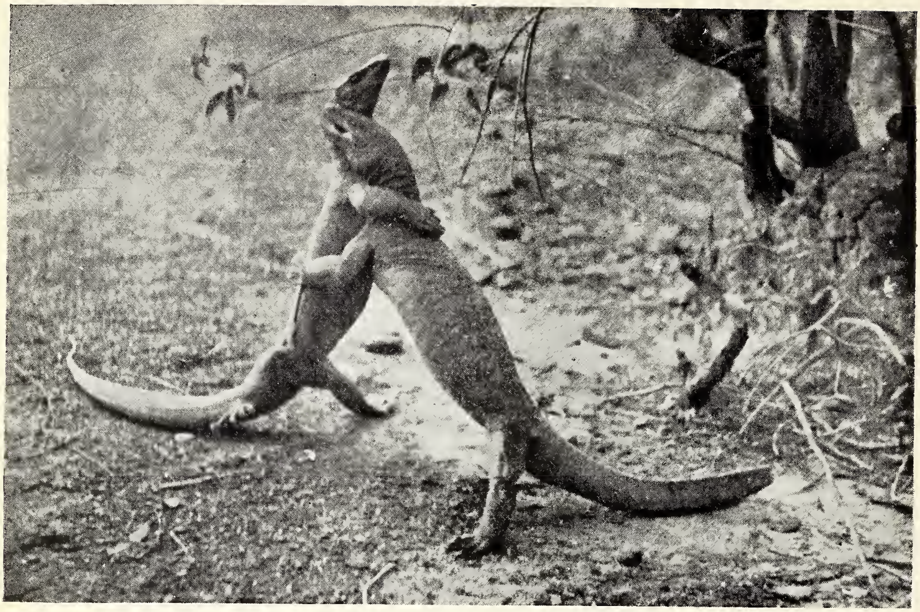
An example of persistence in flighting was that of pack after pack of geese leaving the Hokra preserve near Srinagar from about 8 a.m. till 11 a.m. over the poplar avenue on the main road from Baramulla to Srinagar. It was a common thing to see up to a dozen guns lined up blazing away at the geese going over like formations of air craft. The percentage of kills to shots fired was very low because the birds were practically out of shot and killed only by a chance pellet or brought down owing to a broken wing. Wounded birds were numerous, and there was always a collection of villagers on foot and mounted on ponies on the look out for any that fell in the distance. The reward for retrieving a bird varied with the distance. One brought in by a horseman from a mile or more cost practically the Srinagar game dealer's price. The poplar avenue having become very old and badly affected by borers has been recently cut down opposite Hokra. It will be interesting to see if the geese now go over lower or whether they will still adjust their height to something at which No. 4 shot was irritant rather than lethal.

There is no doubt many shooters are misled. By the way visibility of flighting birds varies from a large number of causes such as the height, speed of flight, amount of daylight still left, cloud, moisture of the air. It is sometimes said any bird you can see flighting is within range. This is most misleading because at one stage of the waning light you see only birds that are a good 100 yards off. Again you kill a bird thought to be a long shot only to find from the density of pellets in it that it was in reality a near shot. It is true that, if you are sitting over a small patch of feeding ground the birds you see as they alight are within shot as also are birds walked up on a feeding ground. It is possible, for instance, to get mallard in this way walking over some very favourite night haunt and taking a snap shot as the bird appears as a black spot for a moment, but this is hardly true flighting. In a true evening flight the shooter has also to take into consideration the varying size of birds, teal low down look much the same as big duck twice as high up.

SRINAGAR, KASHMIR. G. DE LA P. BERESFORD,
December 30, 1943. *Major General.*

XII.—MOULTING OF DUCK AFTER ARRIVAL IN INDIA.

I was very interested in Miscellaneous Note No. XI in the current issue of the *Journal* (Vol. xliv, p. 300) regarding the moulting of duck after arrival in India since I also came across an instance of this some years ago at a village called Tadunia on the



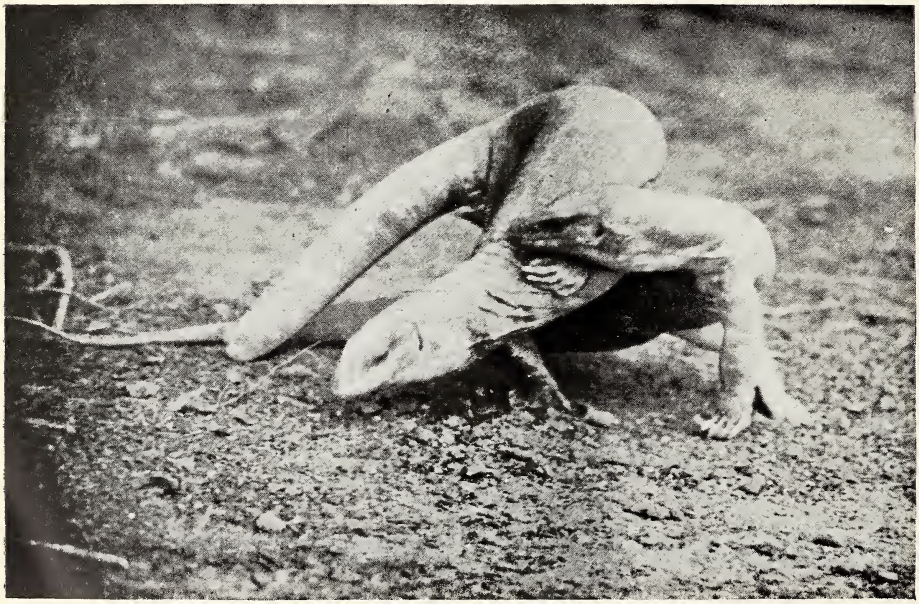


Photo by Courtshipof Monitor Lizards. *Salim Ali*

Simen river in the Sadiya Frontier Tract in Assam when the 'Gam' (Headman) of the village brought me an immature male pintail duck which was unable to fly due to moulting. This was in January so far as I remember and the Gam told me he had chased the duck and caught it with his hands when it was exhausted. He also mentioned that he frequently caught duck in this way during that time of the year. I kept the bird for a considerable time in company with a winged brahminy duck which I secured also but eventually they both died. Incidentally the smaller types of duck have not got separate names amongst the Abor tribesmen but the brahminy is called *Rāmkong* while geese generally are called *Pemuir Puiong* and the general name for duck is *Péjāp*.

'HOPEDALE', R. E. PARSONS,
SHILLONG, ASSAM. *Indian Police.*
January 1, 1944.

XIII.—THE 'COURTSHIP' OF THE MONITOR LIZARD (*VARANUS MONITOR*).

(*With a plate*).

The accompanying photographs were taken by me at Chāduva in Kutch on August 17, 1943. The monitor lizards concerned were rather over 2 ft. long each. One of them, with the tail-tip missing, was the heftier of the two and the more aggressive. Him I assumed to be the male, the other the female. Ostensibly the lizards were engaged in an 'all-in' wrestling match, and many of their grips, catches and throws were surprisingly human. The commonest manœuvre was to stand up on their hindlegs, clasping each other firmly about the neck and shoulders, and then with a sharp sideways jerk of the head to knock the other down—sometimes tossing it completely over. The victor, who invariably happened to be the 'male', now appeared to try and twist the posterior end of the 'female' round into a position suitable for copulation. The struggle, which was interspersed with much bloodless biting on the neck behind the ear, lasted without result for over an hour and a half. Both combatants were panting heavily and were visibly exhausted. Occasional pauses occurred only when the female—who seemed to be more timid than the other—walked away upon my approaching closer with the camera. The male seemed unperturbed by my proximity, at one time under 4 feet. On these occasions the male did not follow or attempt to chase her but stalked slowly over the 'ring' nose to ground, body raised to full height, as if smelling. After retreating a few yards, and within the space of 2 or 3 minutes the female, though she had appeared to be having the worst of the encounters all along, returned to 'Hefty' and the bouts recommenced. This circumstance is enough to suggest that it could not have been a serious fight but some sort of rough courtship that was in progress. After the ungentle handling the female had received it is hard to imagine her returning to the fray of her own accord when she had such a glorious opportunity for escaping. Although 'Hefty' had apparently been winning the whole time he was the first to show signs of exhaustion, and soon afterwards was completely done up. In the final stages the female took hold of his foreleg in her jaws and shook it violently from side to side two or three times, just as a terrier shakes a rat. Upon his still continuing inert she left him with what seemed a frustrated and disgusted sneer, eloquent of much damaging reflection upon his virility! She then deliberately waddled off up a sloping bank and into the shrubbery. It took some minutes for 'Hefty' to recover himself when he too walked away dejectedly in a different direction and with no attempt to follow her.

It would be interesting to learn from some one who has studied the habits of Monitor Lizards whether this was in fact some courtship proceeding and whether such ordinarily leads up to mating.

33, Pali Hill, Bandra. SALIM ALI.
December 7, 1943.

XIV.—THE BREEDING HABITS OF THE COBRA (*NAIA TRIPUDIANS* MERREM) AND THE GREEN WHIPSNAKE (*DRYOPHIS MYCTERIZANS*).

Among other snakes not dealt with in my earlier note on 'the Breeding Habits of Some Snakes'[1] there are two, the cobra and the green whipsnake, of which I have been subsequently able to collect some interesting data. With regard to the cobra, I find that there is some difference in the matter of the mating and the egg-laying seasons from those mentioned by Major Wall. Another feature I observed, and to my knowledge unrecorded, was that one of the female cobras swallowed some of its eggs.

One specimen in the zoo laid 13 eggs on March 5, 1943. Four days later, another one laid 22 eggs. Both these cobras have been kept in captivity for a long time and each had its mate in the same cage all along. Even at the time of the female voiding its eggs, the male snake was found coiled up along with it. It might be probable that the presence of the male is helpful to the other in getting out the eggs, since each egg was brought out by muscular action similar to that exerted by these reptiles in swallowing their prey.

This habit among cobras of association between male and female individuals during reproductive processes even after the fertilization of the ova has been observed among breeding cobras at the Belle Vue Zoological Gardens, Manchester.[2] There the male and the female have been recorded to take turns in incubating the eggs.

The eggs of the first snake in the present instance were of uniform size, whereas those in the other clutch were of different sizes. The cobras moved away from the clutch on the second day after laying. The eggs began to shrink on the third day. These snakes were kept in the cages with their eggs, and it was thus that the snake which laid 22 eggs happened to devour a dozen of them in one day. This was on the fifth day after laying. The remaining eggs decayed after a few more days.

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[1] *J.B.N.H.S.*, vol. xlii, p. 553.

[2] *Proc. Zool. Soc.*, London (1931), p. 1413.

Major Wall mentions that 'the usual month for the deposition of eggs is May' (*J.B.N.H.S.*, 1913, Vol. xxii, p. 551). In this instance it was early in March. A hatchling of this species was caught at a place near Trivandrum and brought to me in the second week of May. It was below a foot in length and evidently not more than a few days old. Taking the period of incubation to be just over two months as ascertained at Parel, the mother might have deposited the eggs in the month of February.

A Green Whipsnake (*Dryophis mycterizans*) was caught in the grounds of the Zoological Gardens on May 4, 1943, and was kept in one of the cages of the reptile house. Though without a mate since its capture, it gave birth on October 23 to 9 young ones born alive and 1 undeveloped embryo in its egg envelope. The young when born measured 11.4 inches.

The period of gestation for this species has not been definitely ascertained. Ferguson who in 1891 recorded the breeding habits of this snake (*J.B.N.H.S.*, Vol. x, p. 6) put the minimum at 59 days. Wall (*J.B.N.H.S.*, Vol. xvi, p. 548) records the instance of an allied species *D. prasinus*, which having remained in the London Zoological Gardens without male companionship for nearly two years and five months, gave birth to 8 young. In the present case (*D. mycterizans*) a minimum of 172 days or nearly six months had elapsed since it had been mated. This long period for gestation might be explained by assuming either that this period must be comparatively longer for the ovoviviparous snakes than for those which are oviparous, or that the fertilisable period of the spermatozoa of these reptiles is of long duration and therefore fertilisation of the ova may take place after a long interval.

ZOOLOGICAL GARDENS,
TRIVANDRUM. E. S. SIMON.
November 10, 1943.

[A pair of cobras have been seen mating on January 2, 1944; the same pair again mated on the 4th. The female of this pair laid 17 eggs on March 5, thus bringing the duration of gestation to 62 days.—E.S.S.]

XV.—A NOTE ON *RANA CRASSA* JERDON, WITH EXTENSION OF ITS RANGE.

Rana crassa Jerdon.

Rana crassa Jerdon, *Journ., Asiat. Soc., Bengal*, xxii, p. 531 (1853).
Rana crassa, Anderson, *Proc. Zool. Soc., London*, p. 199 (1871).
Rana tigrina, part, Boulenger, *Fauna Brit. India*, p. 449 (1890).
Rana tigrina, part, Annandale, *Mem. Asiat. Soc., Bengal*, vi, pp. 122-26 (1917).
Rana crassa, Annandale and Rao, *Rec. Ind. Mus.*, xv, p. 35 (1918).
Rana tigrina var. *crassa*, Boulenger, *Rec. Ind. Mus.*, xv, pp. 51-58 (1918).
Rana crassa, Annandale, *Rec. Ind. Mus.*, xv, pp. 61-63 (1918).
Rana tigrina var. *crassa*, Boulenger, *Rec. Ind. Mus.*, xv, p. 66 (1918).
Rana tigrina var. *crassa*, Boulenger, *Rec. Ind. Mus.*, xx, pp. 20-21 (1920).[1]

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[1] Other synonyms of this frog are given on p. 17, under *forma typica*.

There has been much discussion with regard to *Rana tigrina* and its allies, especially in reference to the systematic rank of Jerdon's frog *Rana crassa* (Boulenger, 1918, and Annandale, 1918). Boulenger (1918) holds that *R. crassa* should be given the status of a variety of the typical *R. tigrina* Daud., since the distinction between the two is a perfect parallel to that between the typical *R. esculenta* and the var. *lessonae*. Annandale (1918), with all deference to Boulenger's contention, gives it the status of a true species. In spite of its structural and ethological differences from *R. tigrina*, *s.s.*, as pointed out by Annandale, Boulenger (1918, p. 66, and 1920, pp. 20-21) firmly adheres to his former contention of considering it a variety of the typical *R. tigrina*.

During the months of August and September, 1943, my pupil Mr. A. N. Choudhury, B.SC., brought me a number of specimens of this frog from the irrigated rice-field of Garia, very near south Calcutta. He also obtained a few young specimens from the Royal Botanic Gardens, Sibpore, near Calcutta. Further, Mr. B. M. Biswas, another pupil of mine, was fortunate enough to catch a single female specimen from a way-side ditch in Hasua, a village in the Gaya District, Bihar, on October 15, 1943. The collection is made up of a dozen specimens, 5 males and 7 females. My thanks are due to Messrs. Choudhury and Biswas for handing over the specimens to me for study.

External characters.—The differences which separate *R. crassa* from the typical *R. tigrina*, as noted by Boulenger (1918 and 1920), are noticeable in my specimens in certain respects. Annandale (1918) has laid considerable stress on the structure of the inner metatarsal tubercle, and in this respect I fully agree with him. The difference in the structure of the metatarsal tubercle of *R. crassa* and *R. tigrina*, *s.s.*, lies not so much in the shape and size, as in its pronounced shovel-shaped character in the former species. In living specimens I have found it to be fairly sharp on its free concave edge. This structure can be superficially compared with that of *R. breviceps* Schneider. In all my specimens the tibio-tarsal articulation reaches between the tympanum and the eye.

Sex characters.—An examination of the reproductive organs reveal that most of the specimens are juveniles. In some males, however, the nuptial pads are feebly developed and their surface is finely granular. The vocal sacs are external and are shaded black, but they are without any longitudinal folds as present in the *forma typica* of *R. tigrina* (Boulenger, 1920, p. 18). It appears from the cases recorded so far that mature males must be smaller in size than females.

Coloration.—Boulenger (1920) notes that a yellow vertebral streak is frequently absent, and that black spots on the gular region are present in some specimens. Annandale (1918, p. 62) observes, ' The colour of living specimens from Madras is similar to that of *R. tigrina*, but much duller, a dull brown being substituted for the greens and yellows, and with the exception that the throat is spotted with black.' The coloration in my specimens is, however, quite characteristic, and differs a good deal from that of the typical

Calcutta forms of *R. tigrina*. The yellow vertebral streak is totally absent, and the large black spots on the gular region are present in all the specimens at my disposal. Further, a few black spots are frequently seen to extend irregularly over the pectoral region and very rarely over the abdominal region. The median gular spots frequently tend to be connected together in such a way as to form a more or less longitudinal bar running from the chin to a little over the pectoral region. In specimens preserved in formalin the black spots faded to a dusky colour. The ground colour of the dorsal surface varies somewhat individually. No doubt it is much duller than that of the typical *R. tigrina*, as noted by Annandale (1918). The black spots of the dorsum get obscured against a dusky ground colour in most of the specimens, while in those with a dull brown ground tone these spots are fairly pronounced. Attention may here be drawn to the apparent similarity between its dorsal colour pattern and that of *R. cyanophlyctis* collected from Calcutta. Furthermore, a parietal fleck, whitish in appearance, is clearly visible between the eyes, while it is almost obscured in the typical *R. tigrina*, as it is placed on the yellow vertebral streak passing over the head.

Tadpole.—Annandale and Rao (1918) and Annandale (1918, pp. 62-63) have assigned two tadpoles obtained from Madras (town) to this species, and showed their slight difference from the typical *R. tigrina* tadpoles. Unfortunately I could not obtain any tadpoles of this species, from Calcutta.

Measurements of seven specimens of *R. crassa* in my collection are given here.

Measurements in millimetres.

—	1 ♀	2 ♀	3 ♀	4 ♂	5 ♂	6 ♂	7 ♀
From snout to vent ...	86	81	80	77·5	77	74	65
Head ...	27	25·5	26	25	24·5	23	21
Width of head ...	29	27	29	27	27	26·4	20·5
Snout ...	12·3	11	11·3	10·2	11	10	9
Eye ...	9	8	9	8	7·5	8	6·5
Interorbital width ...	5	4	4	4·5	5	3·5	3
Tympanum ...	6·3	5·5	6	5·5	6	5·5	5
Fore limb ...	38	37·2	36	31	37	32·5	30
First finger ...	7·8	6·5	8·5	6	7	7·5	5
Second finger ...	6	6	7	5·5	6	6·8	4
Third finger ...	9	8	8	7	8·5	8	6·5
Fourth finger ...	5·7	5	6	5·5	5	6	5
Hind limb ...	112	104	110	93	108	95	76
Tibia ...	37	35	35	33	32	31·5	26·5
Foot ...	36·5	34	34·5	31	33	31	25·5
Third toe ...	16	15	15	16·3	15·5	15	11
Fourth toe ...	23	26	25·5	21	22	21·5	20
Fifth toe ...	21	17	15·8	15	13	15	14
First toe ...	7	7·2	7	5·5	6·5	7	5
Inner metatarsal tubercle ...	5	6	5	5	5	5	4·5

1—6, Suburbs of Calcutta (Bengal) ; 7, Hasua (Gaya District, Bihar), *Distribution.*—Boulenger (1920) gives the distribution of *R. tigrina* var. *crassa*, as Benares and Agra in the United Provinces, Chandbally in Orissa, Madras town, Malabar and Ceylon. This includes the distribution recorded by Annandale and Rao (1918, p. 35) and Annandale (1918, p. 63). Now, the find of *R. crassa* in the suburbs of Calcutta as well as in Hasua is very interesting in that it not only adds another *Rana* to the provinces of Bengal and Bihar, but also bridges over the gap in the distribution of this species. It thus gives *R. crassa* a continuous range from south to north, passing through Bengal and Bihar as far as the United Provinces.

Conclusion.—Unless specimens which intergrade between *R. crassa* and the typical *R. tigrina* could be discovered, as supposed and believed by Boulenger (1918 and 1920) to be present, *R. crassa* should stand as a distinct species; for it can be readily distinguished from the typical *R. tigrina* by its shorter hind-limbs and well-marked shovel-shaped inner metatarsal tubercle, and by its different coloration and peculiar burrowing habits. Further, since the range of its distribution overlaps that of *R. tigrina*, *s.s.*, it may be taken as an additional piece of evidence of considering it specifically distinct (*vide* Annandale, 1918, p. 59).

ZOOLOGY DEPARTMENT,
UNIVERSITY OF CALCUTTA,
35, BALLYGUNGE CIRCULAR ROAD,
BALLYGUNGE, CALCUTTA.
November 29, 1943.

JNANENDRA LAL BHADURI.

XVI.—FURTHER LOCALITY RECORDS OF *RANA HEXADACTYLA* LESSON IN BENGAL, WITH BRIEF NOTES ON ITS TADPOLES.

Previous to 1920, *Rana hexadactyla* Lesson was known only from South India and Ceylon (Boulenger, 1920). Its occurrence in Bengal and probably also in the Punjab (Bhaduri, 1933) and in the Bombay Presidency (McCann, 1934) considerably extends its range, and proves that it is fairly widely distributed. Its rarity is due to its secretive nature helped by its thoroughly aquatic habits and concealing coloration.

Ten large specimens of this frog were caught from a well in Sonarpur near South Calcutta in the month of December, 1942. During last September and November, 1943, a large series of this frog and its tadpoles was obtained by Mr. Satyadeb Mitra, a pupil of mine, from a pond at Konnagar, about nine miles from Calcutta. Further, 2 male specimens were also collected by another pupil of mine, Mr. Sudhir Chandra Mallick, from a pond in Duilla in the Howrah District, some eight miles south-west of Calcutta. He was, however, unable to obtain any tadpoles. To both my pupils I offer my hearty thanks. The entire collection consisted of 12 females, 13 males and 20 tadpoles.

R. hexadactyla, as it appears from the source of collection, could not be obtained from all ponds of the areas mentioned above. It always remains concealed in old ponds amongst a rich green aquatic vegetation. A bright leaf-green colour of the dorsum with the primrose yellow vertebral streak in the living specimen is so characteristic that it leaves no room for mistaking it for any other *Rana* that inhabits Bengal. Juvenile specimens measuring 30-60 mm. in length from snout to vent have black markings on the abdomen and on the ventral side of thighs. Except the throat the ventral side of some of the large specimens is stippled with black spots. In males the inflated vocal sacs are not extensive and are without any pigmentation.

Tadpole.—Tadpoles of *R. hexadactyla* were collected from the same pond at Konnagar whence the adults were obtained, on September 22, 1943. They are fairly large individuals in which the hind-limbs are not quite fully developed.

Tadpoles of *R. hexadactyla* were first described and figured by Ferguson (1904) from Trivandrum. Annandale and Rao (1918) gave brief notes on, and three figures of, tadpoles collected from some localities in South India and Ceylon. Boulenger (1920) examined tadpoles from Cochin only. From the accounts and figures published by the above authors it will be seen, *inter alia*, that the dental formula is very variable.

The largest individual in my collection measured only 9.4 mm. from tip of snout to origin of hind-limbs. The head and body are broadly ovoid as seen from above. Mouth is small and subterminal. The lips are fringed with small papillae on the sides. There are two rows of horny teeth in the anterior lip, the outer is marginal, while the inner second row is broadly interrupted in the middle. There are three continuous rows in the posterior lip, the outer is short and marginal, the inner two rows are of equal length and moderately long. The dental formula, $1:1+1/3$, is ascertained by an examination of a large number of individuals in my collection. It should be noted that some of the tooth rows are apt to fall off completely. Especially this occurs in the inner second row of the anterior lip in several specimens; the dental ridge belonging to this row is, however, clearly visible. Previous authors have noted only a single row in the anterior lip. In the posterior lip one of the rows may be without any teeth, or there may be a break in the middle, giving the appearance of an interrupted row. Probably this early or accidental shedding of teeth has led the previous authors to give different dental formulae. Beaks are broadly edged with black and are very minutely serrated. The upper beak is wide and broadly crescentic, while the lower is V-shaped, as usual. The large number of coils of intestine is discernible through the transparent skin. The anus is median and placed on the subcaudal crest, as noted by Ferguson (1904). The sinistral spiracle is not tubular, and is directed backwards and upwards, visible only from the lower side. The tail is acutely pointed, with subequal crests; the upper crest is much deeper and strongly arched in the middle; the lower crest is 1.5 to 2 mm. deep running uniformly throughout the length of the tail. The tail, as a whole, looks like a sabre. Patches of black pigment are scattered over the dorsum, tail and hind-limbs.

The measurements of two individuals in which the hind-limbs have sprouted with toes fairly differentiated are given:—

Measurements in millimetres.

	A	B
Total length	18.0	24.5
Length of head and body ...	7.4	9.4
Breadth of head and body ...	4.6	5.5
Greatest depth of tail	3.5	4.8

References.

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ZOOLOGY DEPARTMENT,
UNIVERSITY OF CALCUTTA,
35, BALLYGUNGE CIRCULAR ROAD,
BALLYGUNGE, CALCUTTA.
November 29, 1943.

JNANENDRA LAL BHADURI.

XVII.—SAP-DRINKING BUTTERFLIES.

Since the middle of November a large tree of *Cassia grandis* in my garden has been discharging a frothy, sticky and sweet smelling sap from numerous small orifices in the bark of the trunk, from nearly ground level to about 12 ft. above.

This secretion is highly attractive to various insects, many of which keep visiting the tree regularly during the hours of sunlight and even afterwards.

The following visitors were observed and identified:

1. Some very small brownish ants.
2. Very large numbers of flies, chiefly the obnoxious 'bluebottle'.
3. Numerous wasps, mainly the rather formidable and hornet-like *Vespa cincta* and *Vespa orientalis*. Luckily for the observer they were not at all aggressive.

Some brilliantly blue *Sphegids* were also in evidence.

4. Various and interesting butterflies.
5. A small number of small moths after dark.

The following, in the order of their frequency, are the butterflies observed as sap drinkers:—

Melanitis leda ismene Cr.
Charaxes fabius fabius F.
Eriboea athamas agrarius Swin,

Euthalia garuda meridionalis Fruh.
Kallima philarchus horsfieldi Koll.
Lethe rohria nilgiriensis Guer.
Mycalesis mineus polydecta Cr.
Ypthima philomela Johannsen.
Curetis thetis Dry.
Tajuria cippus cippus F.

Melanitis ismene was by preference a late afternoon caller, emerging mainly from a dense hybiscus hedge, covering a wall at the back of a path near the Cassia. They frequently formed dense clusters of over a dozen individuals over a sap orifice and so provided the observer with a good opportunity to appreciate the amazing diversity of their undersides in respect of ground colour and markings.

They usually sat fairly tight and were not easily disturbed and the part of the trunk not more than 3 ft. above ground-level seemed to suit them best.

The swift and sturdy *Charaxes fabius* began at 2 p.m. to chase each other in and out of the foliage of the upper branches, often indulging in twirling 'dog fights' high over the tree. They are fond of basking on leaves, telephone wires and roof tiles, from which coigns of vantage they may be seen darting pugnaciously at such innocent passers by and wayfarers as *Papilio agamemnon, aristolochiae* and *demoleus*, taking a wicked delight in chasing them off.

Once well settled down to sap *fabius* is a very tight sitter, so that they could repeatedly be observed from no further than 2 ft., without getting in the least alarmed, provided the approach was carefully and slowly made.

They very seldom settled below 3-4 ft. from the ground and did so without many preliminaries, after taking a few swift turns round the trunk.

Eriboea athamas, never as numerous as *Ch. fabius*, was decidedly shy, and mostly kept high up in the tree. It never seemed to descend for a drink of sap before 2 p.m. and mostly preserved a degree of wariness even when drinking.

On two occasions *athamas* settled less than a foot from the ground and they almost always preceded this by a whirling flutter within a narrow compass.

Much to the regret of the observer the beautiful *Charaxes imna* never appeared, although the recent finding of two wings of this butterfly on a path in the 'Empress Gardens' had raised hopes of a visit.

Kallima horsfieldi was seen on five occasions. It seemed to materialise as if by magic, without any approach being observed, and invariably at 3 p.m., punctually, settling fairly low on the trunk after the briefest flutter. On three occasions *Kallima* immediately folded its wings and began to drink, whereas this was on the two other occasions preceded by a brief indulgence in basking, during which the beautiful colours of its upperside flashed and glittered in the sunlight. It was not at all shy when drinking.

The little *Curetis thetis* flashed and darted amongst the foliage, frequently basking on the upper side of a leaf, or settling with closed wings on the underside for a rest.

Curetis seldom came to sap and males appeared to be far more numerous than females.

Euthalia garuda loved to bask on sunny spots on the bark and did not drink much sap. It was generally very wary.

Lethe nilgiriensis, Mycalesis polydecta and *Ypthima philomela* were but infrequent visitors, also not uncommon in the locality.

Of *Tajuria cippus* a single male individual was observed drinking.

Such a concourse of happy tipplers could not fail to attract another type of visitor with more sinister intentions. Indeed several small birds were noticed, lurking close by and making darts at the flies. The tailor bird and an olive drab warbler, as well as the redstart, were often seen.

A large gekko was generally ambushed under a leaf and several *Calotes* lizards greedily gobbled up flies without apparently much disturbing the survivors.

A very large preying mantis was a regular caller, conspicuous enough to the human observer, but evidently not so to other visitors, which it seemed to have little difficulty in catching.

It was once seen calmly devouring a fine *Charaxes fabius*, whilst to the amazement of the observer a second *Charaxes* settled not more than 4 inches from the site of the tragedy. It stayed there and preened itself, evidently without being conscious of anything untoward, and quite without fear of its dangerous neighbour.

Would this indifference reflect on the limited intelligence of the butterfly or on the faculty of optical perception of these insects?

POONA. M. SUTER,
October 10, 1943. D.SC.

XVIII.—BLACK ANTS RAID HONEY BEES.

I have read of ant wars and once witnessed a 'battle royal' between large red and black ants on the trunk of a *gular* tree on the *manja* at Fyzabad, but, before witnessing the incident I am about to relate, I had not heard of ants waging war on bees.

About six months ago a swarm of small honey bees settled on a Franciscea bush in the garden and afforded me excellent opportunities to observe them at work at very close quarters. Petunia and Jacquemontia blooms were their favourite flowers and at the time death and destruction came upon them, their home was quite a respectable size.

Watering the Franciscea twice daily, when water was available, and the few showers of rain Karachi was blessed with during the so-called monsoon did not appear to worry them much and they never attempted to attack the *mali* when he created an artificial downpour and literally drenched the Franciscea *and* the hive with his watering-can.

On the afternoon of the 3rd October (Sunday), I noticed considerable movement on and about the hive. Many bees were flying closely around the comb, while others were flying up, but quickly settling again. The surface of the hive had the appearance of perpetual motion, rising and falling in a series of jerky upheavals and undulations. The bees as a mass appeared very agitated and restless.

A closer inspection showed that numbers of large black ants were raiding the bees. Scores of ants were moving up and down the trunk of the shrub, to and fro along the branch to which the comb was attached and along small branches which almost touched the hive at many places.

All the ants were moving either towards the hive or returning from it. On the earth immediately below the shrub were hundreds of ants scurrying about, many carrying away dead bees, whilst others pounced upon bees falling from the hive, hurt or at death grips with ants, and polished them off, carrying away the dead bodies in triumph.

Ants taking part in the main attack ran on to the hive either singly or several at a time, each ant striking viciously right and left with its nippers at the masses of bees swarming all over them, often one, two or even three bees stuck to an ant in a desperate struggle, falling to the ground in a confused heap, only to be pounced upon by one, two or more of the ants scurrying about on the ground below.

In most cases both ant and bee or bees, as the case happened to be, fell to the ground struggling, the bees doing their best to sting the ant, which refused to release the bee first laid hold of, from its vice-like grip.

Many a small ant with head and nippers less formidable than those possessed by the large ones, was bodily carried away by a bee taking to flight no sooner the ant fixed on to it.

While some ants invaded the hive as related above, others, mostly great big fellows with huge heads and nippers, took up positions on small branches and twigs almost touching the hive and struck viciously at bees coming within range of their formidable jaws as the bees heaved about the comb in agitated masses. Many a bee was missed, as the ants appeared to be afraid to get to close grips, but those fairly struck, fell to the ground and were grabbed and killed by ants apparently detailed for mopping up operations below. At times a bee struck by an ant, clung on to the ant and both fell to the ground together. As a rule however the large ants on this sniping duty played great havoc and killed many bees before they suddenly retired or fell to the ground along with a victim.

This feature of sudden retirement without any apparent reason was also noticed among the ants which attacked the comb itself.

The attack appeared to confuse and agitate the bees rather than anger them. Few bees left the comb and those that did, settled again quickly and continued their restless, agitated movements on the hive. It was only when an ant or ants got on to the comb that the bees got really angry, even then few left the comb, but whenever an ant got hold of a bee, as a rule other bees came promptly to the rescue and viciously attacked the ant, holding on to it and trying to sting it. Whether any succeeded in doing so, I cannot tell. I saw no dead ants, but did see at least one ant, which fell to the ground holding fast to a bee, with two other bees sticking on to it, crawl away alive but very sick, after the mopping up ants had disposed of the bee brought down by this ant and the two others sticking on to it.

At times an ant on the comb was attacked by the bees no sooner its presence was detected, but few ants lost any time once on the hive and commenced snapping at the bees no sooner they got amongst them.

Few ants appeared any the worse for bee stings, that is if they were actually stung, but numbers appeared quite groggy after being at close grips with the bees and made their way down the branches of the shrub slowly and apparently painfully.

Others attacking the comb rushed off it and bolted down the shrub without apparent reason, except that they had been in the thick of a general melee, out of which they appeared only too happy to escape.

The raid had been in progress about 20 minutes after I had first observed it and many scores of bees had been killed by the ants, when, without apparent reason, hundreds of bees left the comb, buzzing all round and above it, a few alighting on me, my unprotected face not being two feet from the comb, but not one attempting to sting, perhaps because I remained perfectly still, knowing that the least movement on my part would bring the angry swarm about my own ears.

The buzzing around continued for about three minutes, when, as suddenly as the flying around started, the bees still on the comb left it in one great swarm, which after circling a few minutes over the garden flew off, leaving the comb, on which there were a few stragglers and some young bees, to the mercy (?) of the ants.

The ants soon discovered that the bees had left the hive and scores crawled over the comb eating the honey or attacking the young bees left behind, many of which were pulled out of compartments in the comb, killed and carried off. Young bees with perfectly formed wings but unable to fly, tried to protect themselves by violent buzzing when attacked by an ant. Occasionally an ant was frightened off by this means; but once the ant seized its prey, the buzzing had no effect at all.

In a short while not a bee was left alive. About 50 ants continued to explore the hive, many entering the honey compartments in the upper part of the comb to eat the honey, as they came out in reverse gear with bulging bellies.

At this stage I left them to it and eased my cramped limbs. At 5 p.m. when I again visited the hive, about three hours after I had first observed the raid, only about a score of ants remained on the hive, some so gorged and distended that they could hardly crawl, a few on the shrub and a few crawling about on the ground below. Not a dead or a maimed ant could I find, if any had been killed by the bees they were probably carted off by other ants, though I did not see any ants carrying off anything but dead bees.

I removed the comb and secured nearly half a tea cup of very fine, almost white honey.

The hive had still hundreds of sealed larva compartments which the ants had not touched. Had I left the hive alone it would have been interesting to see what the ants did with the larvae and how they got them out of their sealed compartments.

I was sorry later that I removed the hive, as I would have liked to have seen what the ants did with the bee grubs. Probably they would have torn open the sealed compartments and carried off the larvae as they did the dead bees.

As apparently the bees were unable to cope with the ants, I wonder if they realised instinctively that they would be exterminated if they did not abandon the hive; and how the Queen bee left the comb, whether she was forced to do so by the other bees or whether she did so herself, realising that something was seriously wrong at the hive. I did not see her leave the comb, but she probably did so when the main swarm left the hive in a mass.

The black ants had a nest only a few yards away in the compound wall, which also provides a home for several garden skinks, one a very large one.

Why the ants, which had lived peacefully in close proximity to the hive for months, suddenly attacked the inoffensive bees, is a mystery. Was it hunger, the need for a winter larder or just Ants' 'Kultur'!

KARACHI. K. R. EATES, F.Z.S., M.B.O.U.,
October 15, 1943. *Indian Police.*

XIX.—DRAGONFLIES IN MIGRATION ON THE WEST COAST OF INDIA.

While yachting in the Porbandar harbour one afternoon in the middle of the last month I saw dragonflies and several species of butterflies flying low over the sea and heading towards the land. The dragonflies were far more numerous than the butterflies. On our return to the dock at sun-set I saw millions of dragonflies gathered over the dock area, some hovering, some clinging to whatever they could catch hold of, and more dragonflies were yet pouring in from the direction of the sea. Till noon that day a moderately strong and hot land wind was blowing which changed to a cool sea breeze in the afternoon. It is possible that the hot and strong land wind might have driven them to the sea. That night it rained and most of the dragonflies, exhausted as they were, perished within the next twenty-four hours. The unusually good rain last monsoon accounts for the presence of so many species of butterflies in this otherwise dry region, but I wonder what made the dragonflies congregate in such a vast number. Do they migrate after the fashion of locust swarms? I have seen dragonflies always solitary or in pairs in my garden.

PORBANDAR. V. M. VASU.
November 15, 1943.

[Lt.-Col. F. C. Fraser, in his recently published volume on 'Odonata', *Fauna of British India*, Vol. i, p. 2, refers to the migratory flights of dragonflies, which like many other insects are much given to such movements, though the habit appears to be confined to but a few species. Col. Fraser writes: 'The larger species depend on their own powers of flight for their journeys, but the smaller and weaker species rely entirely on the upper air currents. Migratory flight is usually in a direction from east to west, but during October and November vast numbers of the smaller species may be seen flighting northwards up the west coast, their emergence appearing to coincide with the draining of the paddy fields prior to harvest.' The assemblage of dragonflies seen by the writer of this note during October on the west coast was possibly such an emergence.—EDS.]

XX.—THE CASTOR PLANT (*RICINUS COMMUNIS* LINN.) AND LEPIDOPTEROUS LARVAE.

The following is a list of the Lepidopterous larvae found on the lower leaves of a single Castor plant, growing in a Calcutta garden, on October 8, 1943:—

RHOPALOCERA.

Ergolis merione Cr., *tapestrina* Moore (Nymphalidae).—Large numbers varying in size from newly hatched to full grown. Also numerous ova and two pupae.

HETEROCERA.

Trypanophora semihyalina Koll. (Zygaenidae).—One, full grown.

Pericallia ricini F. (Arctiidae).—Two, about three-quarters grown.

Lymantria ampla Wlk. (Lymantriidae).—At least a dozen, in the first and second instars.

Trabala vishnu Lef. (Lasiocampidae).—Two batches newly hatched, probably about 40.

Altha nivea Wlk. (Limacodidae).—Half a dozen, about half grown.

Thosea tripartita Moore (Limacodidae).—Two, very small.

Achaea melicerte Drury (Noctuidae).—About ten, in the first, second and third instars.

CALCUTTA. D. G. SEVASTOPULO,
October 9, 1943. F.R.E.S.

XXI.—HUNTING WASP PREYING ON BUTTERFLIES.

The antics of a certain species of meat-eating wasp amused me considerably in the jungle there. Species of Castalius (*Nacaduba congregatus*) on the ground were favourite prey. The usual procedure was to fly around and dive at the flies one after the other, usually without much success, but when the wasp got on the ground and stalked them, suddenly pouncing, it occasionally got one. I saw one such wasp hanging on like grim death to a large *P. memmon* ♂, which battered its way over bushes, etc., limping and struggling, eventually shaking the wasp off.

The amount of flesh they can remove from a pigeon carcase in a short time is amazing.

POST BOX 10207, CALCUTTA. J. A. HISLOP,
November 17, 1943. *Capt.*

XXII.—RE. OCCURRENCE OF THE HOUSE SPIDER (*HETEROPODA VENATORIA*) IN THE FIELD

Two days ago while sitting on one of the benches arranged along the bank of the backwater between Sion and Kurla, I happened to roll from under my feet a stone which exposed a moderately large spider. At first I was glad at the thought it might be some Mygalomorphic or Lycosid spider but when I watched it closely it had all the appearance of the Common House spider. On being disturbed it was just attempting to scurry along the trunk of a *Thespesia populnea* tree standing by the side (perhaps its permanent home). Having no other contrivance I caught it in the folds of my kerchief and carried it home. Dropping the specimen in a tube containing spirit I examined it with my pocket lens—definitely a common Heteropodid only. I once again examined all the external morphological details which I give below:—

Colour, muddish brown.

Length of carapace, about 9 mm. Length of abdomen, about 11 mm.

First pair of legs, 43 mm.

Second pair of legs, 48 mm.

Third pair of legs, 38 mm.

Fourth pair of legs, 41 mm.

The specimen was a male one. The palpal organ was well developed whose tibial apophysis was prominent ending in a semicircle with two teeth.

The above are all (especially the last one) characteristics of *Heteropoda venatoria*, which is a common house spider, distributed all over the world particularly in tropical and subtropical regions. Heteropodids of field habits are there. For example, *H. sepunctata* is an outdoor spider resembling *H. venatoria* in many respects. But it is for the first time I have come to see a *H. venatoria* in the field.

I am sending the specimen in question per bearer. Will you please confirm that it is *H. venatoria*? Kindly also let me know if the above information about the occurrence of this species is a new one.

T. V. SUBRAHMANYAM, B.A.

C/o The Cement Manufacturing Co. of India Ltd.,
Esplanade House, Waudby Road,
Fort, Bombay.
December 20, 1943.

XXIII.—FLOWERING OF STROBILANTHES.

A note in the *Journal* on *Strobilanthes* flowering has prompted this belated record from the Nilgiris.

There was a big gregarious flowering of *S. kunthianus* on the southern side of the Nilgiri plateau from the months of June to October 1942. The flowering was at its height, and at its best, in July/August.

The area which flowered was very considerable. It covered Thiashola Estate and its surrounding country, Carrington Estate, Kinaconnie village, Melkundah village, Kilkundah village to the edge of Bikkerti village, Chamraj Estate, and along the Ooty/Kundah Road to two miles beyond Devashola village.

With Thiashola Estate at one end, and the point beyond Devashola village at the other, the distance by road is some 24 miles. The extent of this flowering was somewhere approaching a block of the hills 20 miles by 20 miles square. Much of this area carried a dense growth of *Strobilanthes* on open hill sides and was a sheet of blue. The western end flowered first, and the flowering followed a processional course east and north; that at the northern end being a month to six weeks later.

The flowering produced a huge invasion of the big rock bee, which builds exposed combs. There were several hundreds of these combs hanging on the *Grevillea* shade trees of 100 acres of coffee near here. The honey taken from these nests was the best I have ever tasted in India. It was thick and black—the colour of black treacle. It had a strong and distinctive flavour, slightly reminiscent of heather honey, and granulated in a short time when kept.

These bees undoubtedly followed the *Strobilanthes* flowering, as there have been no nests here at all this year, though the country is full of the usual annual flowers and flowering trees.

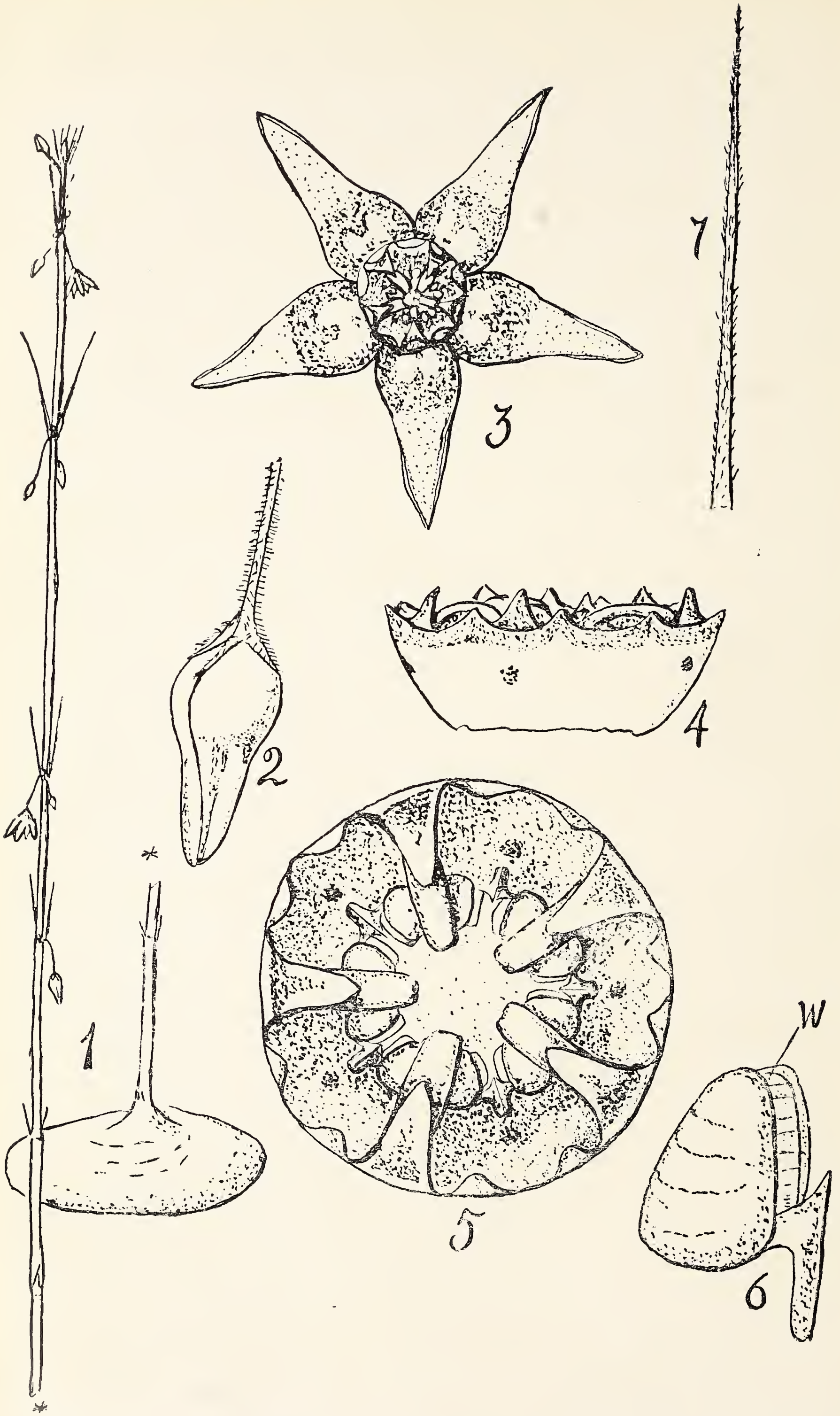
THIASHOLA ESTATE,
KILKUNDAH P.O., NILGIRIS. J. L. H. WILLIAMS.
October 9, 1943.

XXIV.—THE GENUS *BRACHYSTELMA* R. Br.: AN ADDITION TO THE FLORA OF THE BOMBAY PRESIDENCY.

(*With a plate*).

In the *Flora of British India* [vol. iv (1833), pp. 64-66], Sir J. D. Hooker recorded seven species of the genus *Brachystelma*: three of these were originally described by Wight under the genus *Eriopetalum*; one was described by Beddome under the genus *Ceropegia*; and the remaining three were described by Hooker himself. Before describing the Indian species Hooker made the following remark:—'The following descriptions are all very imperfect.' In some instances the description is based on a drawing, or but a single flower! Such is the position with regard to the species of this singular genus. T. Cooke has not recorded any of the species of this genus as occurring within the limits of the Bombay Presidency as comprehended in his *Flora*.

As I am attempting to revise the genus *Ceropegia*, I have asked all my friends, who are likely to lend a helping hand, to keep a



Brachystelma laevgatum Hooker *f.*
(1) Entire plant; (2) Bud, enlarged; (3) Flower; (4) Corona, lateral view; (5) Corona, top view; (6) Pollen-mass; (7) Leaf.

sharp look out for tubers of *Ceropegia*, among them (not the *Ceropegias*!) was Mr. Salim Ali. During his recent ornithological survey of Kutch State Mr. Ali obtained some tubers of *Ceropegia*. Soon after I had put the respective tubers in pots, they sent up fresh shoots, sufficient to allow me to identify them. One of the tubers presented a bit of a puzzle, as I soon saw it was not that of a *Ceropegia*. After a little head racking (I had never seen this plant before) I discovered it to be a species of *Brachystelma*—*B. laevigatum* Hook. *f.* is the species to which it answered best, as in all the other species, the flowers are too large. I now give a fuller description taken from the living plant and also reproduce the generic description for those to whom Hooker's work is not readily available.

Genus: **Brachystelma** R. B. Bot. Mag. (1822), t. 2343.

Erect or twinging pubescent or glabrous herbs with tuberous roots. *Leaves* opposite, sometimes very narrow or minute. *Flowers* few in axillary sessile umbels or solitary, pedicels very slender. *Corolla* (in the Indian species) rotate; lobes 5, elongate, valvate. *Corona* short adnate to the column, annular, variously 5-10 lobed or toothed, lobes or teeth erect or incumbent on the anthers. Column very short; anthers ovoid, tips inappendiculate, retuse; pollen masses one in each cell, sessile globose, erect, one margin pelucid. *Stigma* nearly flat. Follicles slender, smooth. *Seeds* comose. (Hooker *f.*).

Brachystelma laevigatum Hooker *f.* Fl. B.I., vol. iv (1883), p. 65.

Eriopetalum laevigatum Wight Contr. (1834), p. 35; Wall. Cat. 8149; Dcne. in DC. Prodr., vol. viii (1844), p. 646.

'*E. laevigatum* (Wight.) corolla segmentis linearibus margine undulatis fere glabris tubo subduplo longioribus, corona staminea gynostegium aequante.' (Descr. ex. *Contributions*.).

Gomphocarpus laevigatus Ham.

Description.—*Tuber* 40 x 20 mm., depressed. *Stem* slender, erect, minutely puberulous, up to 45 cm. high, flaccid. *Leaves* minute below, increasing in length upwards, acicular, or somewhat subulate, erect, or ascending, minutely puberulous with somewhat glandular-based hairs on both surfaces, up to 30 x 1-1.5 mm. *Flowers* in sessile umbels of 3-4 flowers in each, pendulous; pedicels filamentous, 7-10 mm. long, minutely puberulous, enlarging in fruit; calyx 5-partite, divided to the base, segments ovate-lanceolate, apex subacute, softly hairy. *Corolla* rotate, petals 5 x 1.5 mm., lanceolate or oblong-lanceolate, apex subacute, red-purple in the basal $\frac{1}{3}$, the remainder ochreous, tinged with purple, finally becoming entirely purple on fading, exteriorly dull green, margins somewhat hyaline towards the apex, reflexed. *Corona* two seriate, saucer-shaped, the outer composed of 5 bifid lobes, the teeth subacute, glabrous; between the bifid lobes arise 5 longer teeth from the margin of the 'saucer' which bend inwards and over the anthers; the margin of the saucer and the lobes are coloured red-purple, the lower portion is translucent white; the inner corona is formed of the 5 green oblong anthers curved downwards towards the stigma. Pollen-masses waxy, yellow, with a hyaline wing, caudicle purple. *Stigma* flat, green. *Follicles* not seen.

Locality.—Chaduva, Kutch (S. Ali in Herb. McCann 4933 !).
Distribution.—India, Northern Oudh (H.*f.*), Kutch.
Field notes.—The whole plant is a glaucous green or often tinged with purple. The tubers are edible.

Note.—In the corona of this plant we find one of the links in the chain towards the formation of the corona in the genus *Ceropegia.* In *Brachystelma* the outer corona is 'apparently' composed of 15 teeth: 10 of which are formed by the bifurcations of the 5 outer-coronal lobes as seen in *Ceropegia*: and, of 5 longer teeth arising from the margin of the coronal 'saucer'. In the genus *Ceropegia* it is these 5 longer teeth, which become elongated and unite with the anthers thus forming the so-called *inner-corona* or *processes* in that genus. In *Brachystelma* the inner-corona is formed by the anthers which are not adherent to the *processes;* the processes partly cover the anthers as will be clearly seen in fig. 5 of the plate illustrating *Brachystelma.* It is not my desire to pursue the development of the corona in the *Asclepiadaceae,* but merely to draw attention to the transition noticed.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY.
March 30, 1944.

CHARLES McCANN, F.L.S.

XXV.—*VENTILAGO BOMBAIENSIS* DALZ.

(*With a plate*).

Ventilago bombaiensis, Dalz. in Hook. *Bot. Journ.*, iii, 36.

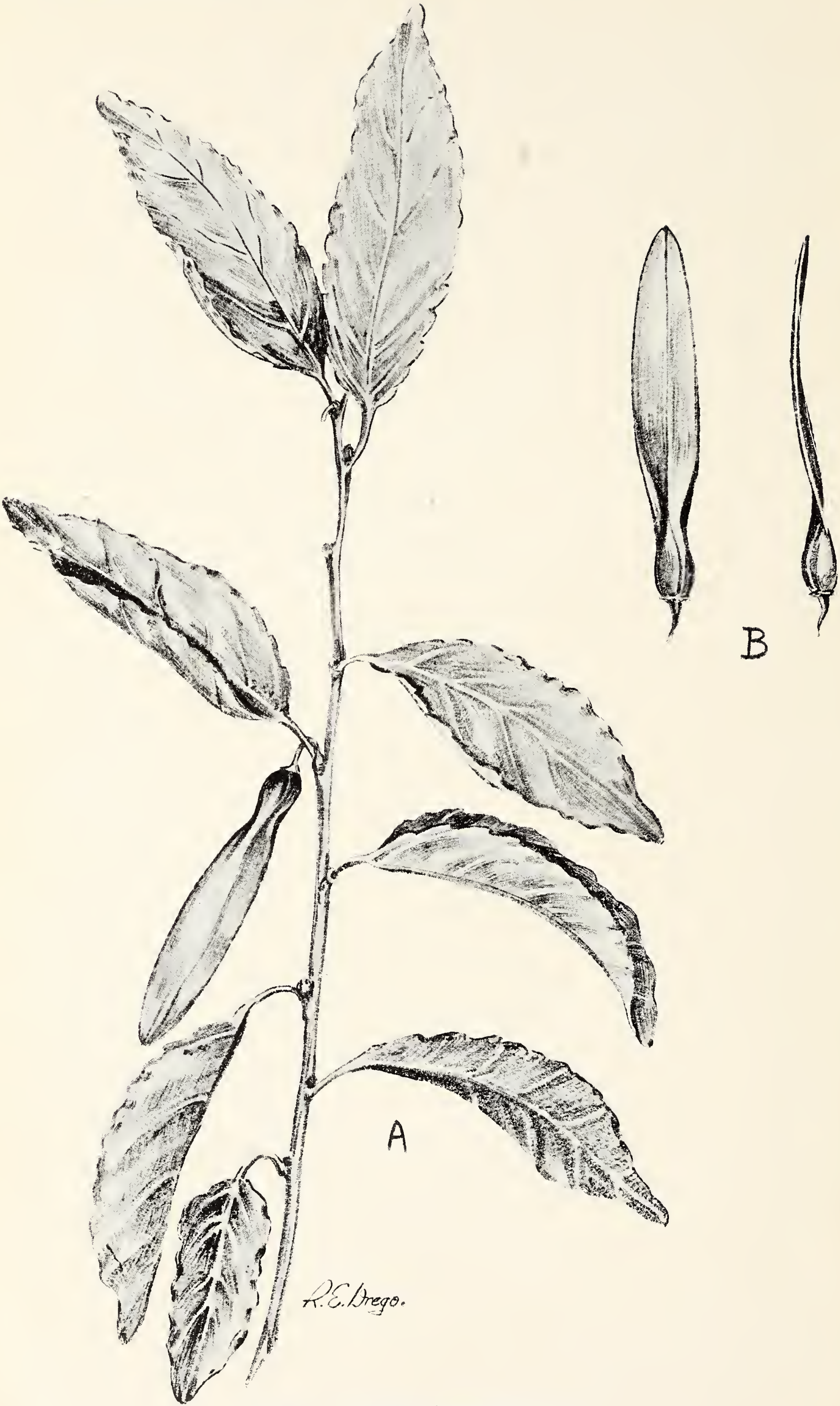
There seems to be a good deal of confusion regarding the identity of this plant, due principally to the fact that the fruit has not been seen or has not been fully described up to the present. Both Cooke (*Fl. Pres. of Bomb.*, i, 239) and Talbot (*For. Fl.*, i, 293) confess that they have not seen the fruit. Gamble gives a very meagre description of the fruit:—

> 'Calyx-tube saucer-like, embracing the base of the nut, wings with golden velvety pubescence' (*Flora of Madras*, p. 218).

Dalzell & Gibson give the following description of the plant:—

> 'Branchlets, petioles and flowers covered with fulvous tomentum; leaves lanceolate acute at the base, unequal, acuminated at the apex, crenated, crenatures with callous points, glabrous on both sides, shining; flowers fascicled in the axils of the leaves, shortly-pedicelled. Chorla Ghaut: flowers in February. This species is distinguished from the preceding (i.e. *V. madraspatana* Gaertn.) by the very different inflorescence, while the costal veins in the leaf of the preceding are double in number, and form a much larger angle with the midrib.' (*Bomb. Fl.*, p. 48.).

Ventilago bombaiensis Dalz. has so far been collected from Chorla Ghaut by Dalzell; from Devinana Ghaut and Castle Rock by Gammie and Sedgwick and Bell working independently; Beddome also mentions it from the moist woods in Wynaad at 3,000 ft.



Santapau—**Ventilago bombaiensis** Dalz.

Recently we have collected it on several occasions from Khandala, where it is very common in some parts. The Blatter Herbarium possesses abundant material of this plant; besides the specimens of Sedgwick and Bell [Sedg. Herb. nos. 3400, 6909 (I), 6909 (II)], we have the following specimens collected in 1943 and 1944 from Khandala, viz. nos. 1847, 1848, 1849, 1936, 1937, 1938, 1939, 1940, 1941, 2137, 3502, 3503, 3504, 3505, 3506, 3507, 3508, 3509, 3581. It is worthy of note that this is the only species of *Ventilago* to be found in the dense jungle at the foot of Echo Point, at an altitude of 1,200 ft.

V. bombaiensis is not a tree, but a lofty climber, very similar in habit to *V. madraspatana* Gaertn. There is a specimen of the former plant climbing over the top of *Beilschmiedia fagifolia* var. *Dalzellii* Meissn., which is one of the tallest trees in that part of the forest. Stems dark, bluish-green, longitudinally striated and with long internodes; young parts fulvous pubescent.

Leaves up to 11.5 x 4.5 cm., acute or acuminate, crenate, the crenatures ending in a callous, reddish point, shining and deep green above, paler and dull below; main nerves 3-6 pairs, each nerve forming an angle of about 30° with the midrib, with a rufous hairy gland in the axil between the midrib and each of the main nerves. Base conspicuously unequal to subequal, acute or subacute or nearly rounded. The larger size of the leaves with fewer nerves, the angle between the midrib and lateral nerves and the presence of the rufous hairy glands in the axils of the main nerves, unmistakably distinguish the leaves of this plant from those of *Ventilago madraspatana* Gaertn.

Flowers small, greenish yellow, about 4 mm. diam., 6-12 fascicled together in the axils of leaves towards the ends of the branches; many of the flowers seem to fail to reach the fruiting stage, and this is why at maturity there is only one or two fruits in the axils of most leaves. The flowers are shiny with large amounts of nectar which lies exposed to the surface above the disc. The illustrations given by Talbot (*For. Fl.*, i, 290, figs. 172 and 173) under the title of *Ventilago madraspatana* Gaertn., belong to *V. bombaiensis* Dalz. (except for the fruit drawn on the top right-hand corner of fig. 173, which is truly that of *V. madraspatana*); in our Khandala specimens, *V. bombaiensis* has flowers in small fascicles in the axils of the leaves; *V. madraspatana* has flowers in large terminal panicles which are usually leafless; and this is why we say that the illustrations given by Talbot must be assigned to *V. bombaiensis.*

Fruit. A one-seeded nut of about 8 x 7.5 x 4 mm., laterally compressed, supported at the base by the persistent, saucer-like calyx, and prolonged into an oblong-lanceolate wing of up to 60 x 15 mm.; wing not constricted above the nut, as is the case in *V. madraspatana* Gaertn., but gradually tapering from the middle towards both ends, apex rounded, terminated by the remains of the style, base slightly twisted just above the fruit, so that this forms an angle of about 45° with the main plane of the wing. There is one main nerve along the middle of the wing running to the apex, with a number of fainter nerves which run almost parallel from the base to about half way up and then anastomose freely among themselves. Colour of the ripe fruit brown, that of the wing being much lighter than that of the nut. Both nut and wing are pubescent with fulvous pubescence. Seeds one in each nut, 10 × 6.5 × 3 mm., of about the same colour as the nut, surface rough, base of the seed tapering to a point, apex gradually becoming thinner and occasionally with a slight twist corresponding to the twist in the base of the wing.

The fruit was collected at Khandala on the slopes below Echo Point at an altitude of 1,200 ft., on April 19 and 30, 1943, also from the ground in the forest on the slopes below Elphinstone Point on June 8, 1943. Flowers were seen and collected below Echo Point on December 30, 1943, and January 16, 1944.

ST. XAVIER'S COLLEGE,
BOMBAY. H. SANTAPAU, S.J.
January 29, 1944.

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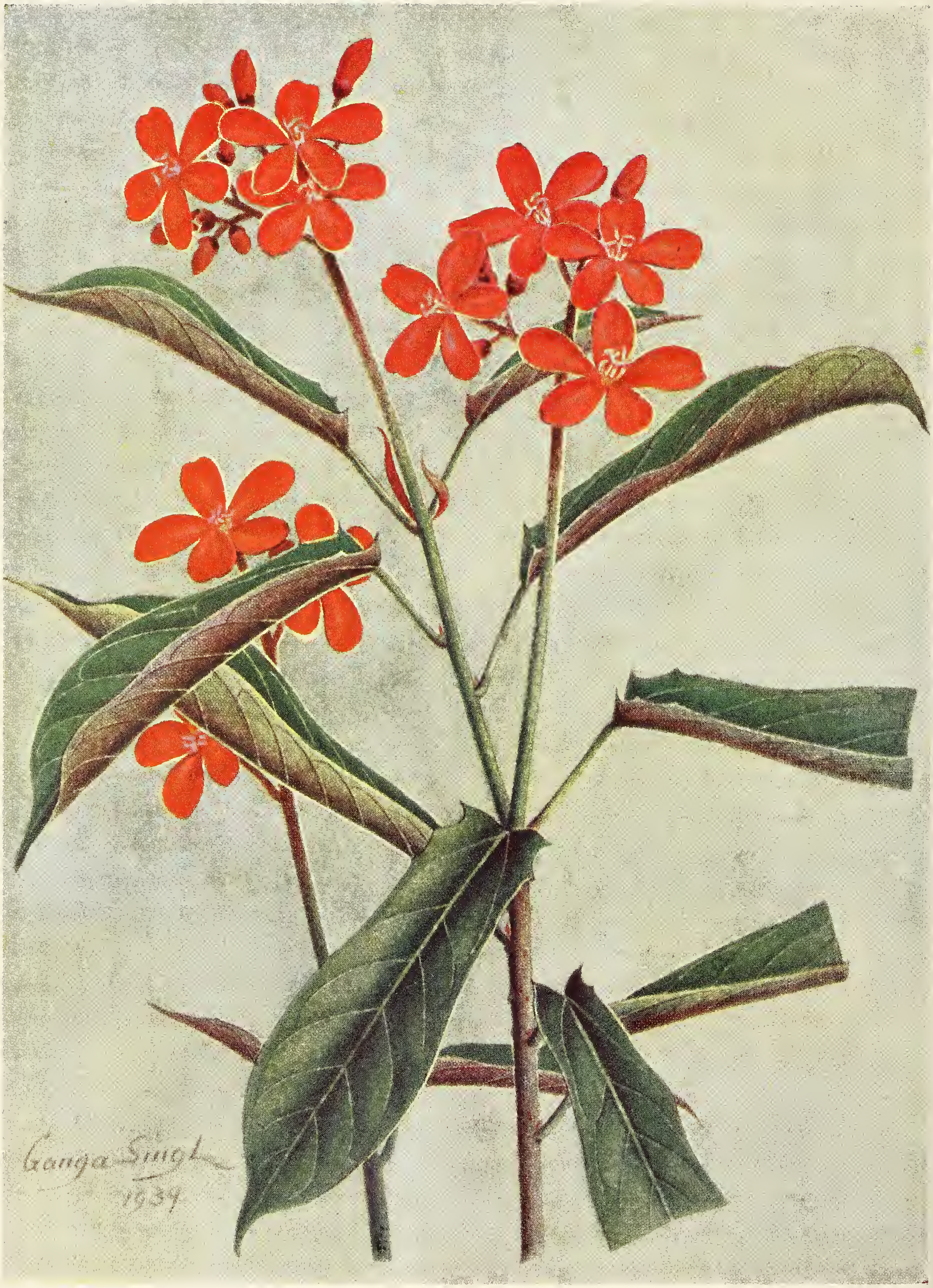
NOTICE TO MEMBERS

The Nature Calendar for 1945 issued by the Society will be available by the end of September. Price Rs. 3 (Price to members Rs. 2-4-0). Packing and postage extra.

114 (6) Apollo Street,
BOMBAY, 8*th September* 1944.

J. L. BERNARD,
Honorary Secretary,
Bombay Natural History Society.


Ganga Singh
1939

Fiddle-leaved Jatropha.
JATROPHA PANDURIFOLIA Andr.
(Nat. Size.)

TO MEMBERS

he recent Paper Control (Economy) Order of the rnment of India compels the Society to limit its al to an issue of 120 pages inclusive of illustra- cover and index. We express our regrets to ers and to contributors, publication of whose s is necessarily delayed.

EDITORS

JOURNAL

OF THE

Bombay Natural History Society.

1944. Vol. XLIV. No. 4.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. Bor, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

M. B. Raizada, M.SC.,

Assistant Forest Botanist,

Forest Research Institute, Dehra Dun.

Part XVII

(*Continued from Vol.* xliv, *No.* 3 (1944), p. 321).

(*With* 1 *coloured and* 4 *black and white plates, and* 3 *text-figures*).

Part II

2. **Jatropha** Linn.

This large genus comprises some 160-170 species and contains some ornamental plants which are cultivated in our gardens. In it are to be found trees, shrubs and herbs, the latter frequently with a thick perennial rhizome. The leaves are alternate, petiolate or sometimes sessile, lobed or cut in various ways, glabrous or pubescent, often glandular.

The inflorescence is a terminal cyme, the female solitary and terminating all axes, the male lateral. The flowers are unisexual, found on the same, or on different plants, often with calyx and petals. Sepals 5, imbricate, often more or less joined together.

FEB 20 '45

Petals 5, imbricate, free or joined together into a five-lobed tube, sometimes absent. The disk may be entire or divided into five glands. Stamens usually about 10, often in two series, the outer series seated upon the petals. The filaments are often joined together. The anthers open by longitudinal slits. In the male flowers there is no rudimentary ovary. The ovary is 2-5-celled with a solitary ovule in each cell. The styles are joined together at the base, shortly divided into 2 branches. Capsule dehiscing into 2-valved cocci. The endocarp is crustaceous and the seeds (bear a caruncula.

Many species of the genus are graceful plants with pretty foliage and brightly coloured flowers. A number of them, therefore, are cultivated in gardens in the tropics.

Apart from the striking flowers the species of the genus are remarkable for possessing poisonous substances in the sap or seeds. One or two species protect themselves from browsing animals by the possession of stinging hairs of peculiar construction. Each hair consists of a single large cell expanded at the base and elongated above, ending in a small knob which is bent to one side. The wall of the hair at the bend is extremely thin and the slightest touch is sufficient to break off the head, leaving a sharp oblique point. The sharp oblique point will penetrate the skin of men and animals and the pressure from the expanded end of the hair injects the contents of the hair into the skin. The principal contents of a hair are formic acid but there are also present some other substances resembling unorganised ferments or enzymes. The formic acid gives the burning sensation but the ferments act as a poison.

Jatropha curcas Linn., a native of America, is not a garden plant but is well known in India where it is frequently grown as a hedge, being easily raised by cuttings or from seed. The sap of this plant is used by Naga children, when diluted with water, for blowing bubbles. The juice also has some repute as a fish-poison. The leaves are used medicinally in a variety of ways, the juice being a styptic and rubifacient.

It is the seed, however, which has made this plant notorious on account of the many cases of poisoning which have occurred after eating it. The seeds contain a toxalbumin which is rich in oil. The poison is an albuminoid called *curcin*. The absence of any unpleasant taste when eating the fruits makes the plant a dangerous one when children are about.

The oil which can be extracted from the seeds is put to a variety of uses. It is inflammable and burns without smoke. It can be made into soap and is used in wool-spinning.

KEY TO THE SPECIES

Stem much swollen at the base.	... *J. podagrica.*
Stem not swollen at the base.	
Leaves entire, fiddle-shaped.	... *J. pandurifolia.*
Leaves lobed.	
Lobes 5; petiole, leaves and stipules glandular.	... *J. gossypifolia.*
Lobes 5-11; leaves etc. not glandular.	... *J. multifida.*

Jatropha podagrica Hook.

Gautemala Rhubarb; Gouty-stemmed Jatropha.

(*Podagra* is a Latin word meaning 'gouty', and refers to the swollen base of the plant.)

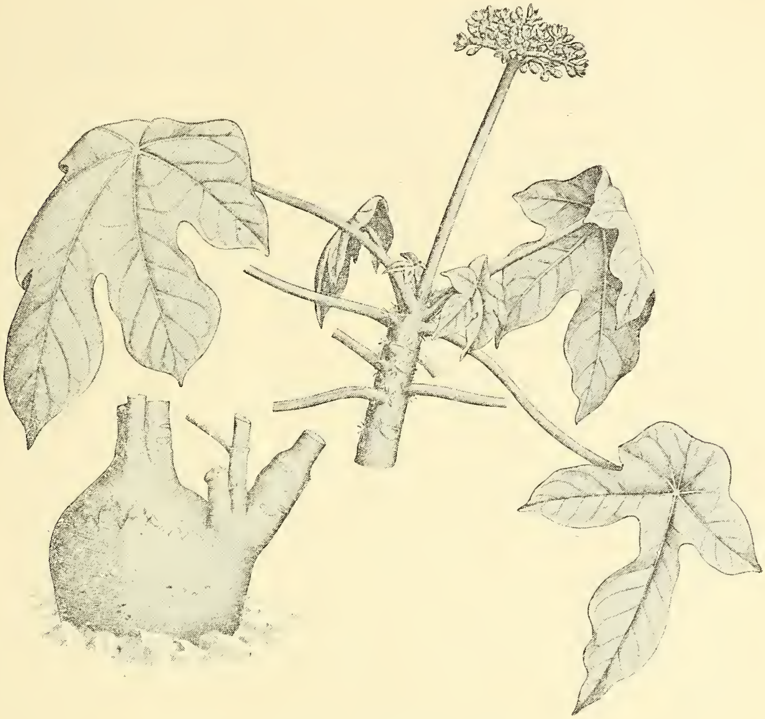


Fig. 1.—*Jatropha podagrica* Hook. ×½.

Description.—A shrub 2-3 ft. tall. The base of the stem is grotesquely swollen as are also the bases of the branches. The branches are soft and succulent, deeply scarred where the leaves have fallen away. Each of the more recent scars has two stipules, one on either side which persist for some time after the leaves have fallen. These stipules are broad and are deeply cut into setaceous lobes, sometimes glandular. The peltate leaves which are seated on succulent pedicels up to 1 ft. long are 1 ft. long or less by 8 in. wide, 3-5-lobed, perfectly glabrous, green above, glaucous beneath. The lobes are entire, somewhat ovate in shape.

The cymose inflorescence is borne on an elongated, succulent, light green peduncle; branches and pedicels red; flowers unisexual; male and female flowers in the same inflorescence. The female flowers are borne in bracts on the branches of the inflorescence. The calyx is cup-shaped, 5-lobed; lobes erect; petals 5, 0.3 in. long, orange-red or scarlet, spathulate, slightly joined together at the base; ovary ovate, seated on a fleshy disk with five glands: style short, divided into several green stigmas. Male flowers much more numerous than the female and above them. Sepals and petals as in the female flowers. Stamens 6-8, seated in a yellow disk, furnished with 5 yellow glands; filaments red, 1.5 in. long; anthers yellow, hastate 0.1 in. long. Fruit a capsule up to 1 in. long, green, 3-celled, with one seed in each cell, ellipsoid in shape, depressed at both ends.

Flowers.—Chiefly during the rains. Fruits cold season.

Native country.—Indigenous to Panama, now common in gardens throughout India.

Gardening.—A peculiar gouty-stemmed under-shrub having cymes of rather pretty scarlet flowers. Suitable for a rockery. Propagated by division or seed.

Jatropha pandurifolia Andr. (*J. hastata* Griseb.)

Fiddle-leaved Jatropha

(*Pandurifolia* is Latin for 'with fiddle-shaped leaves')

Description.—A shrub up to 6 ft. tall with slender, graceful branches. Branches greenish-brown with prominent lenticels. Leaves alternate, stipulate, petiolate, fiddle-shaped, shallowly cordate at the base, where there are 3-4 glandular teeth on each side, up to 4 in. long by 2 in. wide, smooth and glabrous dark green on the upper surface, paler or with a purplish tinge below. Stipules small, subulate. Petioles up to 1½ in. long. Inflorescence a small terminal cyme; peduncle purple or purplish-green, slender. Male and female flowers on different plants. Male flowers: calyx small, cup-shaped, 5-lobed, purplish-red in colour 1-2 in. long; petals spathulate 0.25-0.5 in. long, scarlet, twisted in the bud, with a covering of short, white hairs inside at the base; stamens 8, often 4 long, 4 short; filaments joined in a column, red; anthers reddish-yellow, hastate. Disk present, glandular, 5-lobed. Female flowers: calyx as in the male flower but longer. Petals and disk the same as those of the male flower. Ovary ovoid, glabrous, attenuate into a column at the summit; styles three, bifid from the middle into filiform branches. Fruit a capsule, purplish-green in colour.

Flowers.—Practically all the year round but chiefly during the rains. Fruits ripen cold season.

Native country.—Native of Cuba. Commonly cultivated in the Tropics of both hemispheres.

Gardening.—A pretty, rather slenderly branched shrub with fiddle-shaped leaves and bright crimson flowers. It is desirable to prune the plant severely during the cold weather in order to prevent it from becoming scraggy. Readily propagated by cuttings or by seed.

Jatropha gossypifolia Linn.

Bellyache Bush.

(*Gossypifolia* is Latin for 'with leaves like the cotton plant').

Description.—A shrub up to 6 ft. tall with rather soft, succulent, brownish-green branches, much scarred where the leaves have fallen away. Leaves up to 6 in. long, 6 in. wide, petiolate, stipulate, 3-5 lobed, of a deep purplish-red at first, afterwards green; lobes elliptic-

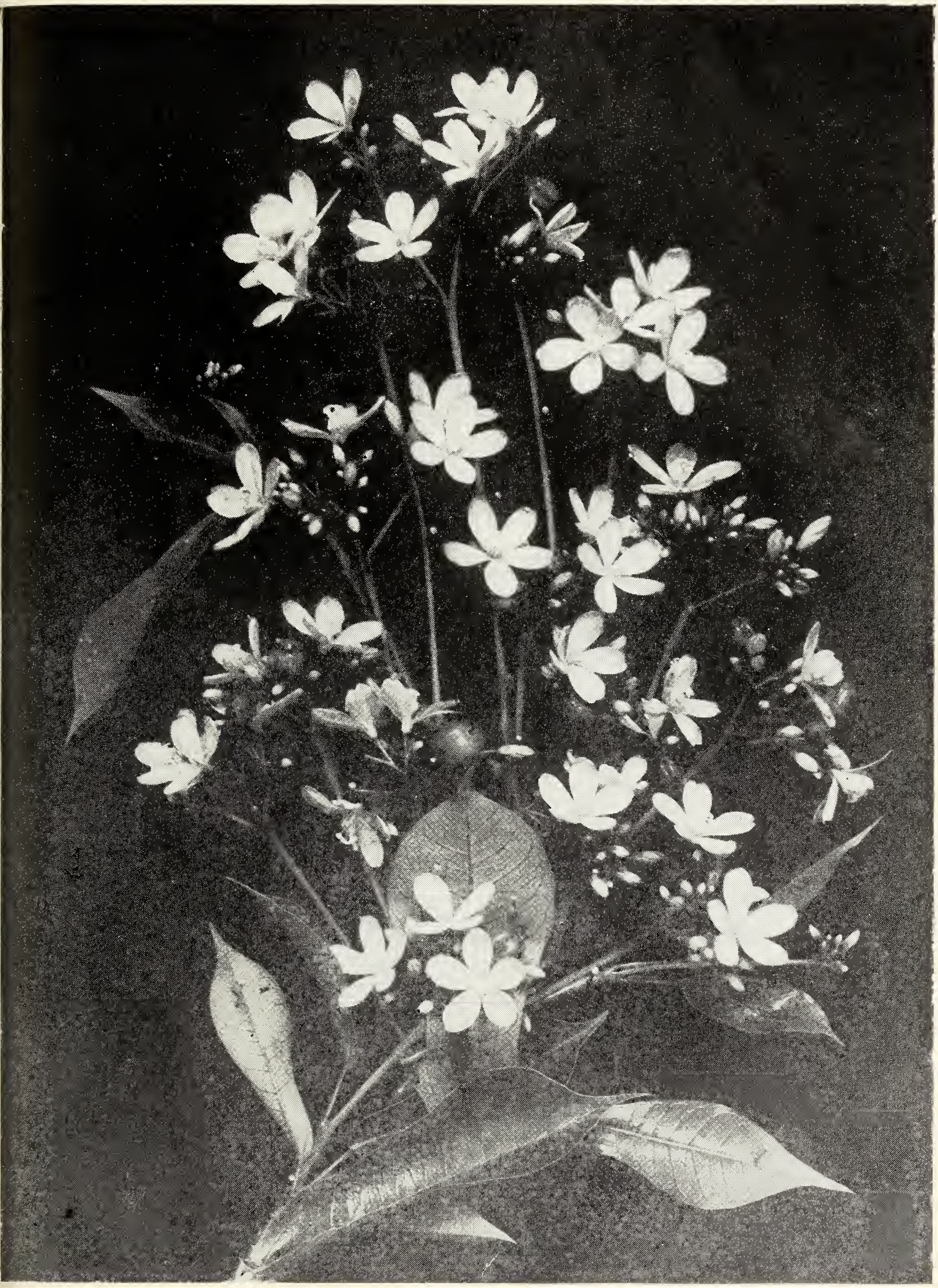


Photo by

Jatropha pandurifolia, Andr.

M. N. Bakshi.

New Forest, Dehra Dun.

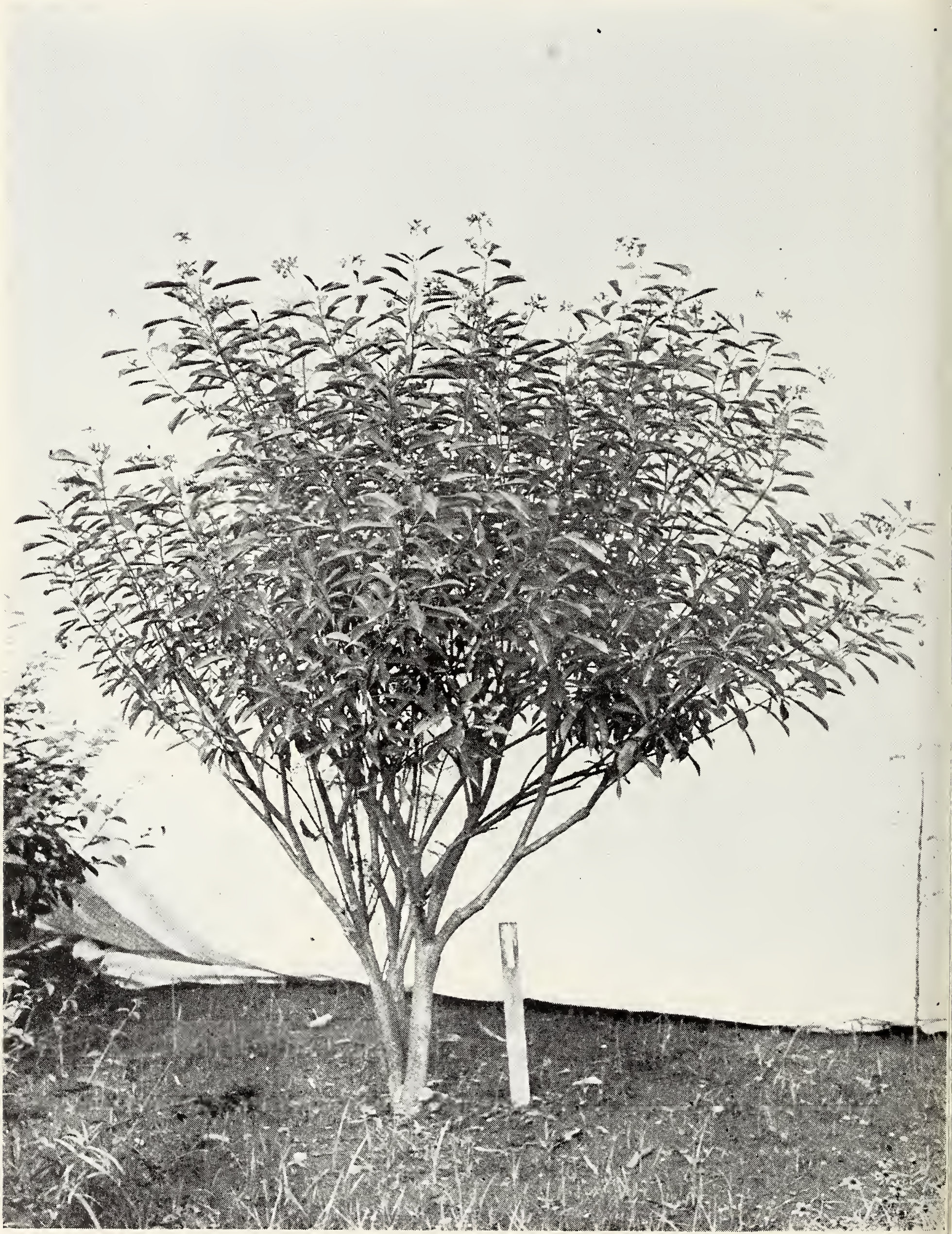


Photo by M. N. BAKSHI.

Jatropha pandurifolia, Andr.

New Forest, Dehra Dun.

acute; petioles up to 4 in. long, colour of dried blood, covered on the upper surface with glandular hairs branched from the base and mixed with simple hairs; stipules of glandular hairs branched from the base. Margins of the leaves ciliate with simple, white hairs and also furnished with gland-tipped hairs.

Inflorescence a terminal cyme seated upon a short, thick, dark-red peduncle. Male and female flowers on the same plant or on different plants. Calyx .25 in. long, consisting of a short cup with 5 lanceolate, gland-margined lobes. Petals, hardly longer than the calyx lobes, dark red, crimson or purplish in colour, pale at the base, broadly obovate in shape; tip rounded. Ovary globular-ellipsoid, smooth, seated on a glandular cup-shaped disk; style-column short; stigmas three, each dividing into two rugose plates. Stamens 6-8; anthers horse-shoe shaped, crimson; filaments pale, connate in a central column issuing from a glandular disk. Fruit a capsule .4 long 3-furrowed, truncate at both ends. Seed greyish-red, marbled with black, bearing a caruncle.

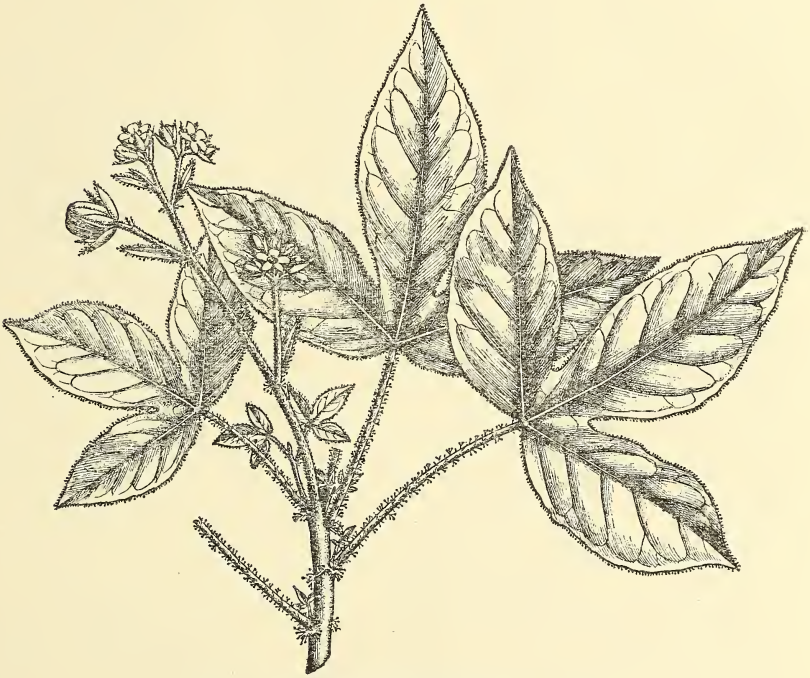


Fig. 2.—*Jatropha gossypifolia* Linn. ×2/3.

Flowers and Fruits.—Chiefly rainy season.

Native country.—Native of Brazil, cultivated or naturalized in various parts of India and Burma.

Gardening.—A shrub with 3-5-lobed leaves; easily recognised by the stipitate, yellow, viscid glands which cover the leaf margins, petioles and stipules, and by the small red flowers in glandular corymbose cymes. Easily raised from seed. It is deciduous in the cold season.

Economic and Medicinal uses.—The seeds of this plant are said to be eaten by doves and fowls, although they contain much oil which is a drastic purgative and emetic. A decoction of the leaves is used as a blood purifier and for venereal diseases. The root has some repute as an antidote for snake bite (Standley).

Jatropha multifida Linn.

The Coral Plant or Physic Nut.

(*Multifida* is Latin for 'much divided' and refers to the palmately divided leaves the lobes of which are often again divided).

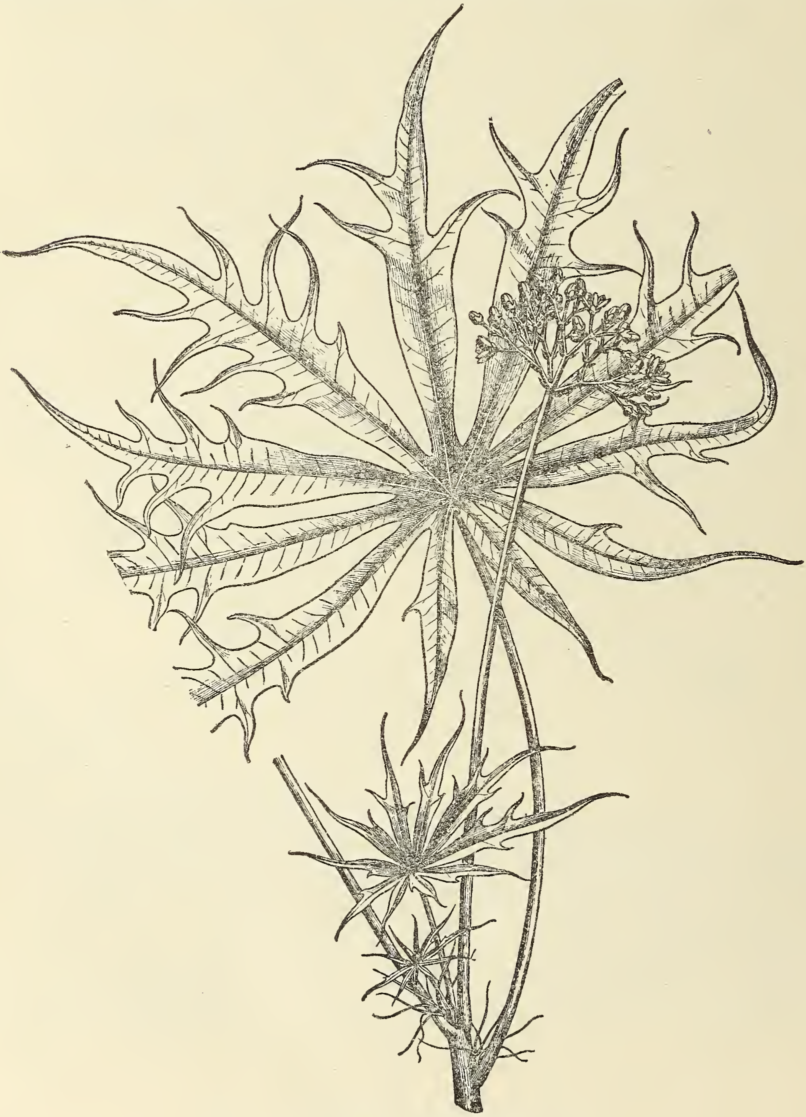


Fig. 3.—*Jatropha multifida* Linn. ×2.

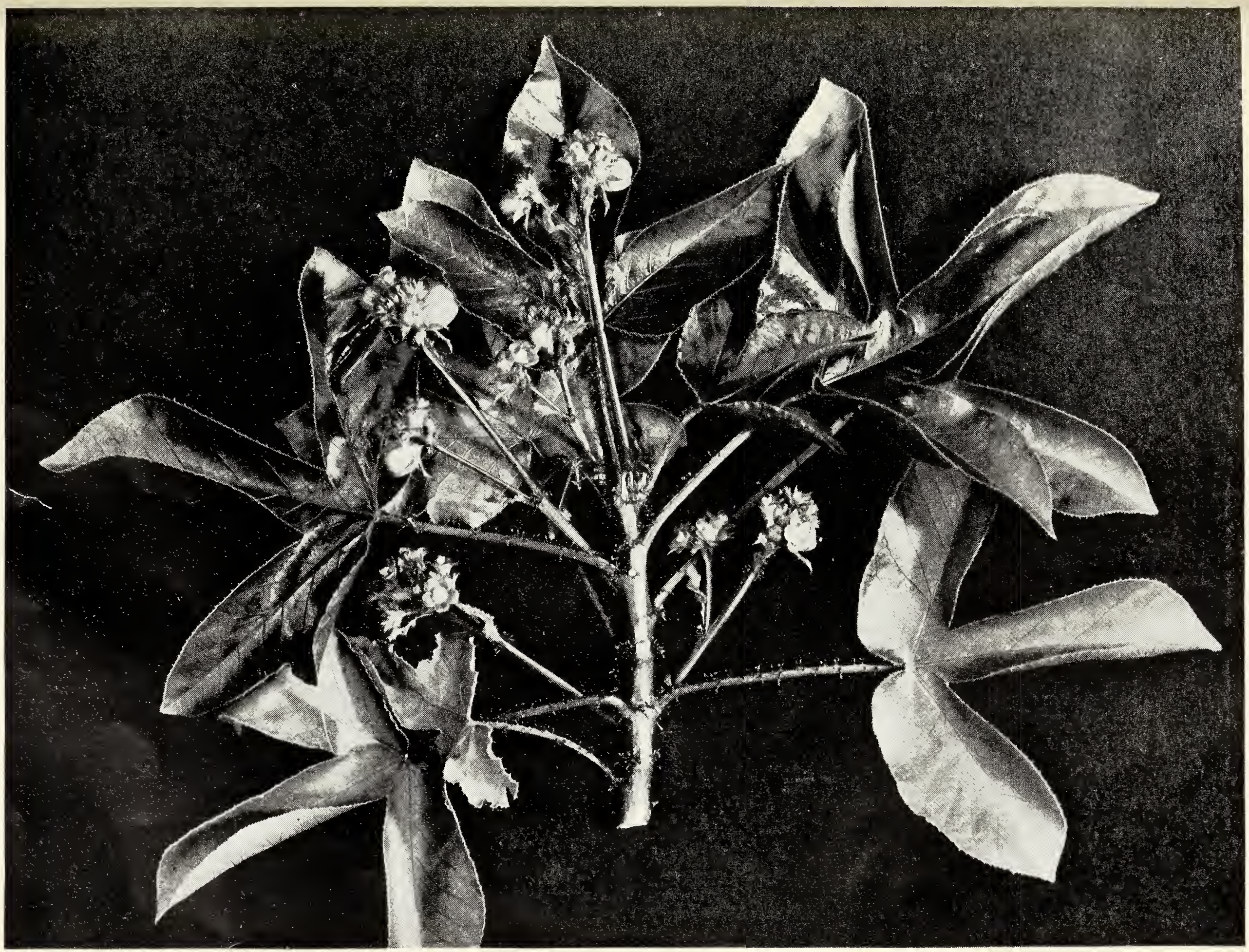


Photo by M. N. Bakshi.

Jatropha gossypifolia, Linn.

New Forest, Dehra Dun.

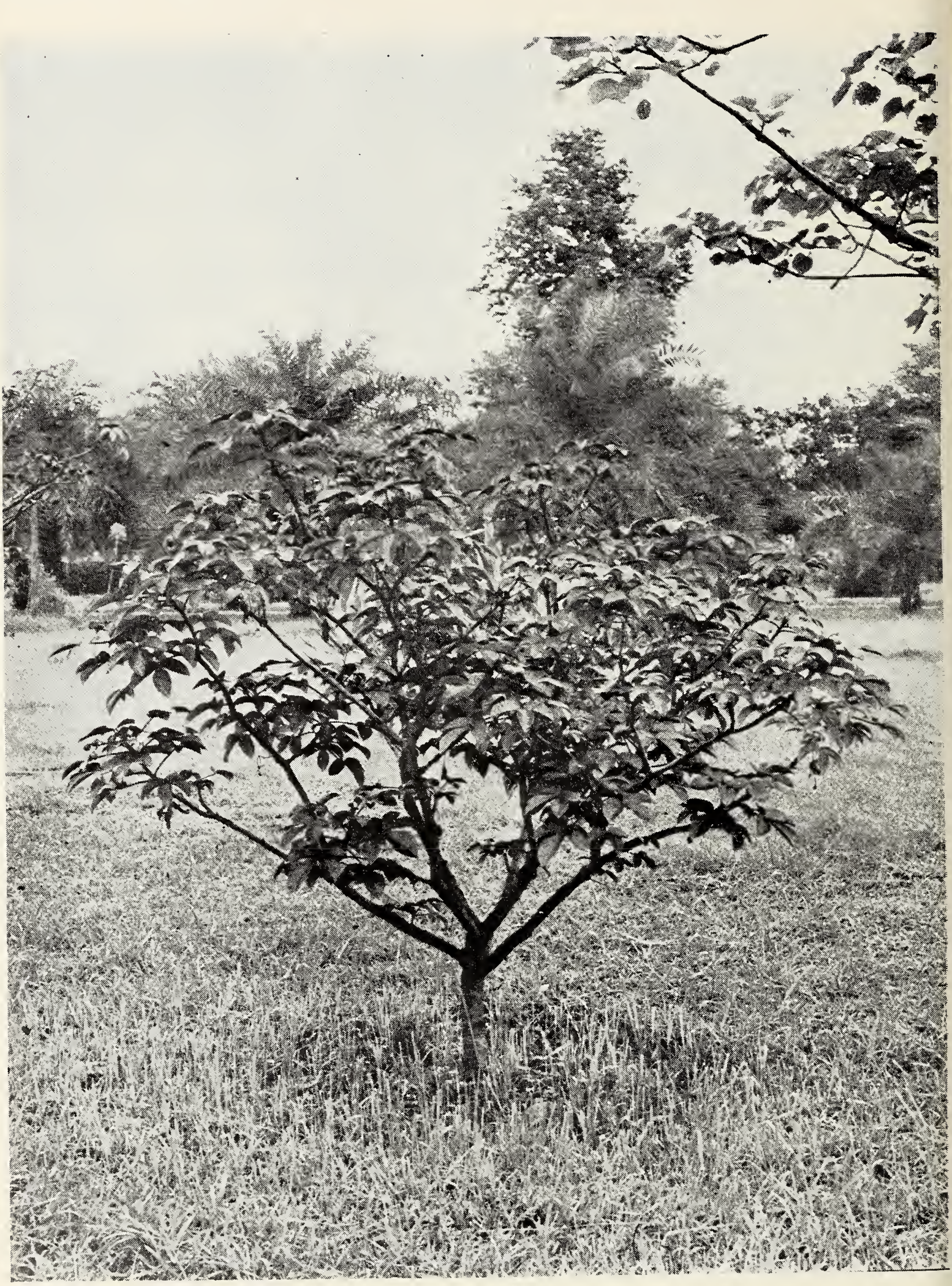


Photo by M. B. Raizada.

Jatropha gossypifolia, Linn.

New Forest, Dehra Dun.

Description.—A shrub or small tree with thick soft branches. Leaves long petiolate, deeply divided in 5-11 lanceolate-acute, linear or elliptic-acute lobes, the lobes often again lobed, green above, often pale-pink below, green at maturity. Stipules short, subulate, branched. Petioles a foot long or more, smooth and glabrous.

Inflorescence a many-flowered, long-pedunculate, terminal cyme, branches slender, reddish in colour. Male and female flowers on the same plant. Calyx gamosepalous, shortly 5-lobed; lobes short, rounded at the tips. Petals five, oblong or broader above, rounded at the tips, red or purplish, .2 in. long. Stamens 8-10; filaments connate for a short distance; anthers linear Disk cup-shaped; glands prominent. Ovary seated on the disk, three-celled. Fruit a capsule, obovate in shape, smooth, yellowish, about 1 in. long.

Flowers and Fruits.—Chiefly during the rains.

Native country.—Native of South America, commonly cultivated in gardens throughout India.

Gardening.—A handsome garden plant with rather pretty foliage and coral red flowers. Propagated by seed.

Economic and Medicinal uses.—The leaves are said to be cooked in Mexico as a vegetable. The yellow sap is used in Brazil for the treatment of wounds, and the roasted seeds for fevers and venereal diseases. The seeds are purgative like those of many other species.

(*To be continued*)

MATERIALS FOR THE ORNITHOLOGY OF AFGHANISTAN.

BY

HUGH WHISTLER (Deceased).

PART I

The starting point of this note on the Birds of Afghanistan is to be found in a collection of about 250 birds made in Afghanistan for the British Museum by Sir Richard Maconachie during part of his tenure of the responsible post of British Minister in Kabul. Sir Richard Maconachie is not and does not claim to be an ornithologist. He was, however, on leave in England in 1932 and hearing of his presence in London Mr. N. B. Kinnear and myself asked him if he could do anything to procure a series of birds from Afghanistan for the British Museum. We had long had our eyes on that country and thought of various expedients for throwing some fresh light on the ornithology of an interesting area so close to India and Baluchistan. Sir Richard was very sympathetic to our aspirations and he was finally kind enough to agree that if some arrangement could be made for a skinner he would do his best to procure a representative series of birds for the British Museum. A skinner was in due course trained and provided, largely through the good offices of Mr. H. W. Waite, Indian Police, a keen student of Punjab ornithology, and to cut a long story short some 250 birds were collected in Afghanistan in 1933 and 1934, mostly from the neighbourhood of Kabul, though the official visits of members of the minister's staff to other parts of the country added some interesting species to the list.

The British Museum entrusted the identification of this collection to myself and kindly asked me to write a note on it for publication. I have therefore seized the opportunity to make this note as comprehensive as possible by including in it the scattered information available on the subject of the Birds of Afghanistan in the hope that it may be useful to other workers to have a convenient summary of the present state of our knowledge and in the still greater hope that this paper may inspire some of the various western officials now resident in Afghanistan to profit by their opportunities and study the birds of the country in earnest. Afghanistan has hitherto shared with Turkestan the fate of being a kind of ornithological waste paper basket for Continental Asia. These two countries have been added almost automatically to the distribution of any species whose range, habitat or breeding quarters have been imperfectly known and this tendency has naturally confused rather than improved our knowledge. I hope in the following papers not to write any full account of the birds of Afghanistan—that is impossible in the present state of our knowledge—but at least to indicate what species are known to occur in the country and what information is available as to their distribution and status. It will then be incumbent on any future writer to disclose the source of his statements if he desires to be taken seriously in using Afghanistan to cover the deficiencies in our knowledge of any species.

There is no need to describe Afghanistan here. The main features of the country can be obtained from any Encyclopaedia and I cannot amplify them. In view of the fact, however, that the boundaries of the country have, especially in the South-east, been varied since the earlier papers, hereinafter listed, were written, I should like to make it clear that I have followed the present political boundaries of the country, the more particularly because records from places like Chaman, spoken of by earlier writers as being in South Afghanistan, have already been summarised by Dr. C. B. Ticehurst in his excellent paper on British Baluchistan (*Journal Bombay N. H. Society*, 1926-27). I have, however, allowed myself some latitude over the localities round the Hamun-i-Helmund, partly because I have failed to find whether some of them are on the Persian or Afghan side of the border and partly because in dealing with a drainage basin of this type one may be satisfied that a record from one side of the boundary is illustrative of the area generally.

This paper has undergone many vicissitudes. It was nearly ready for the press when I learnt that Colonel Meinertzhagen was proceeding to Afghanistan and I delayed it to include a summary of the results of his expedition which were exceedingly valuable. The paper was then redrafted but held up again on the news that Mr. J. L. Chaworth Musters was going to collect mammals for the British Museum in Afghanistan and would also collect birds. Mr. Musters returned about the beginning of the War and it then transpired that he had brought no birds from Afghanistan and the delay had been unnecessary.

The Battle of Britain and the consequent evacuation of much of the collections in the British Museum have prevented my examining critically a number of specimens listed hereafter or necessary to elucidate various points: in spite of this and because further collecting in Afghanistan must necessarily now remain in abeyance for an unknown period I have thought it better to publish the paper as it stands. It will then be ready, when peace comes once again and men have leisure for scientific work, to furnish a resumé of our existing knowledge and a starting point from which some future ornithologist can write a proper account of the Birds of Afghanistan.

In conclusion my thanks are due to Dr. Baini Prashad of the Indian Museum for the willing help he has given me by turning up and furnishing information on a number of Afghan specimens in the Calcutta Museum. Mr. N. B. Kinnear was not only behind the original inspiration of Sir Richard Maconachie's collection on which this paper was primarily based. He has in addition provided me with much information about the various officers who made the early collections in Afghanistan and given me much other help in the preparation of the paper. For all of this I am under a great debt of gratitude to him.

Before proceeding to enumerate the species of birds known to occur in Afghanistan and the information available about each of them, I have thought it desirable to give a list of the various books and papers which I have been able to consult for the purposes of this compilation. These papers are somewhat numerous but a careful examination of them will show that what information there is comes largely from the borders of Afghanistan. Little or nothing is known of the birds of the heart of the country or of the greater part of the Hindu Khush and its associated ranges, an area which must prove of the utmost interest. This literature is as follows, arranged in chronological order with some notes on the contents of the different items.

1843. VIGNE, G. T.—A Personal Narrative of a visit to Ghuzni, Kabul and Afghanistan and of a residence at the Court of Dost Mahomed with notices of Runjit Sing, Khiva and the Russian Expedition (London, Routledge).

[P. 136 contains an account of the 'Churk Falcon' commented on by Blyth in his notes to Hutton's paper].

1847. HUTTON, CAPTAIN THOMAS.—Rough Notes on the Ornithology of Candahar and its neighbourhood [with some additional information on the Birds of Afghanistan—by E. BLYTH, Curator of the Asiatic Society etc., etc.] *Journal Asiatic Soc. Bengal*, 1847, vol. xvi, pp. 775-794.

[Captain Hutton was originally in British service but during the First Afghan War saw service in the 'Pay and Commissariat Department of Shah Soojah's force'. His heavy duties prevented his making many observations, for he was 'generally at the desk from sunrise to sunset', but he succeeded in producing a useful list of 128 species. To this Blyth added some notes and described *Athene bactriana* as new. In an earlier number of the Journal Blyth had already described *Malacocercus huttoni, Carpodacus crassirostris* and *Melanocorypha torquata.*

Here reference may be made to Sir Alexander Burns whose drawings are mentioned in this paper by Blyth. SIR ALEXANDER BURNS, the brilliant traveller and political officer, was deputed in 1836 to proceed with Dr. Lord to Kabul, as Commercial Agent. While there he employed a native artist to make drawings of birds.

Some time previous to 1840 the drawings, together with notes by Dr. Lord, were presented by Government to the Asiatic Society of Bengal. The drawings were very crude and notes of little value, but nevertheless the Council of the Society decided to publish them and arrangements were made for the drawings to be lithographed.

In the meantime Edward Blyth had arrived in Calcutta to take up the post of Curator of the Society's Museum, and the notes were handed to him to prepare for publication. He, realising that the publication of the drawings and notes would only bring the Society into disrepute, apparently did nothing. The Secretary brought the matter before the Council and a stormy correspondence ensued which, however, came to an end by the death of the lithographer and the financial difficulties of the Society. The work was never published, but a few copies of the plates were bound, one of which is in the Linnaean Society. Blyth, in his notes on Captain Hutton's papers, refers to the species figured and also a small number of skins presented by Burns to the Society's Museum.]

1854. HORSFIELD, THOMAS and MOORE, FREDERIC.—A Catalogue of the Birds in the Museum of the Hon. East India Company. Two volumes (London, W. H. Allen).

[This is important for the information it contains about the Griffith collection.

WILLIAM GRIFFITH was a young doctor in the service of the Honorable East India Coy. and in addition to his medical qualifications was an excellent botanist. In this latter capacity the Company had employed him on two occasions and, shortly after his return in June 1838 from Bhutan, where he had accompanied the mission of Capt. Pemberton as medical officer and botanist, he was ordered to join the army of the Indus, then preparing to invade Afghanistan. His instructions were to accompany the army and report on the natural products of the country. From Calcutta he travelled via Cawnpore to Loodhiana, where he arrived on 10th December 1838. He immediately commenced collecting, not limiting his activities to plants, but including mammals, birds and fishes as well. On his way down the Indus he shot at Shikarpur the types of *Phoenicurus ochruros phoenicuroides* Horsf. & Moore, and *Dryobates scindeanus* Horsf. & Moore. Leaving the river he marched with the army through the Bolan Pass to Quetta, and on to Khandahar, thence to Ghuznee,—was present at the battle on 23rd July—and finally reached Kabul on 12th August 1839.

Twelve days later Griffith joined a small force which was proceeding to Bamian via the Hajigak Pass. At 'Topekee' 12,000 ft. twelve miles from Bamian, he shot a 'Chukor Ptarmigan' *Tetraogallus h. himalayensis* and also reports Chukar (*Alectoris*), See-see (*Ammoperdix*), and Rock Nuthatches (*Sitta*) seen on the way. From Bamian the force marched south to the upper waters of the Helmund river and then returned to Kabul. Leaving again early in October Griffith travelled via Jagdalak, Futtehabad, Sultanpore and the Khyber Pass to Peshawar, arriving there on 7th November.

Anxious to visit other parts of the country Griffith obtained permission to accompany a column which was leaving Jalalabad for Kunar, on the Kunar river, a tributary of the Kabul river. Kunar was reached on 15th January 1840, and next day an attack was made on a hostile fort, but owing to the heavy rains damping the gunpowder it was unsuccessful. Three days later the fort was evacuated and by 16th February the country was considered quiet and the troops returned to Jalalabad. Griffith, however, remained behind with Capt. Macgregor, and after some time at Pashat he went with that officer on 2nd March to 'Chugar Serai' (Chaghan Serai). Through Capt. Macgregor's influence he remained there alone with his servant until the end of April, when, owing to disturbances, he had to return to Jalalabad. While at Chaghan Serai he visited Otipore and Bharowl, on the borders of Kafiristan. At Pashat he obtained the type of *Ruticilla rufogularis* Moore (=*Phoenicurus erythronotus erythronotus*) and at Bharowl *Orites leucogenys* Moore (=*Aegithaliscus leucogenys*). At the last named locality a female Monal was brought in to him and along with it the first known example of *Pucrasia macrolophus castaneus* Gould.

During his stay in the valley Griffith records the arrival of many migrants, but owing to his limited knowledge it is not always possible to identify all the species. On reaching Jalalabad Griffith had a bad attack of fever and was laid up for several weeks. Later he was sent to Kabul to recoup and from there set out to join Lieut. Surly, who was surveying on the Turkestan frontier, but again owing to disturbances he had to return without getting further than 'Kurzar', north of the Bamian river. Returning to Kabul on 23rd September 1840 he proceeded to Peshawar and finally left Afghanistan.

Griffith had no pretensions to be an ornithologist, but nevertheless acquired some knowledge of birds and kept notes of all he saw. Owing to his limited amount of baggage he made all his skins flat and notwithstanding all his journeys and the wet weather they are still in fair condition in the British Museum. While in Afghanistan he collected 350 specimens of birds, 150 skins of fish—his spirit specimens got destroyed—and 1,500 species of plants, including a great number of duplicates, and travelled 1,600 miles.

The bird collection did not reach the East India Coy.'s Museum till 1843, and unfortunately was first examined by Dr. William Jamieson in India, who appears to have mixed some of Griffith's Khasia Hills specimens with the Afghan collection. The specimens were labelled with large pieces of country paper, but many of the original labels are now lost, and on some the locality is very vague. This probably accounts for the bad mistakes made by Moore in the Indian Museum Catalogue, in which a number of Khasia Hills birds are attributed to Afghanistan and in two cases, at least, he attributed new species to the wrong locality.]

1879. Wardlaw-Ramsay, R. G.—Ornithological Notes from Afghanistan. Paper I, *Ibis*, 1879, pp. 444-9.

1880. Wardlaw-Ramsay, R. G.—Ornithological Notes from Afghanistan. Paper II. On the birds of the Hariab District, *Ibis*, 1880, pp. 45-71.

[Both papers refer to the same period and locality, the Hariab Valley and the Peiwar Spur of the Sufed Koh above it where Wardlaw-Ramsay arrived on 18th April 1879 during the course of the Second Afghan War. He made careful notes and collected a number of specimens now in the British Museum but he left unexpectedly for England on 10th July '80 so the paper only covers a period of about three months.]

1882. SWINHOE, LIEUT.-COLONEL C.—On the Birds of Southern Afghanistan. *Ibis*, 1882, pp. 95-126.

[Refers to the neighbourhood of Kandahar where Swinhoe arrived on 6th Oct. 1880. He left again apparently on 22nd April 1881. He made a collection of birds which are now in the British Museum.]

1887. MURRAY, J. A.—Zoology of Baluchistan and Afghanistan. *Indian Annals and Magazine of Natural Science*, vol. I, nos. 1-3.

n. d. MURRAY, J. A.—The Zoology of Beloochistan and Southern Afghanistan (Bombay Education Society's Press).

[These two books are very scarce and difficult to consult. The latter is undated and I have not been able to ascertain the date of publication, but it apparently appeared not long after the paper in the *Indian Annals and Magazine*. Murray lists a number of specimens as obtained in various localities between Quetta and Kandahar by a Mr. C. F. Hutchins but I have thought it better not to include these. Some appear very improbable and Murray's work is not always reliable.]

1887. SCULLY, J.—On the Mammals and Birds collected by Captain C. E. Yate, C.S.I. of the Afghan Boundary Commission. *Journal Asiatic Soc. Bengal*, 1887, vol. lvii, pt. ii, no. i. pp. 77-89.

[A collection of 110 species was made by Capt. Yate after the departure of Dr. Aitcheson (vide next title but one). I believe that these birds are in the Indian Museum, Calcutta].

1888, YATE, MAJOR C. E.—Northern Afghanistan or Letters from the Afghan Boundary Commission (London, William Black-wood).

[A descriptive account of the travels of the Mission, whose birds are described in the preceding and following items.]

1889, SHARPE, R. BOWDLER.—The Zoology of the Afghan Delimitation Commission. Transactions of the Linnaean Society of London, Second series, vol. v, Zoology, Birds, pp. 66-93. (Plates VI, VII and 2 maps).

[Dr. J. E. T. Aitcheson was attached as Naturalist to the Afghan Delimitation Commission of 1884-1885 and in that capacity made collections in all branches of Natural History. These included 123 species of birds and *Gecinus gorii* Hargitt, *Passer yatei* Sharpe and *Phasianus principalis* Sclater were described as new and figured in colours. Much of the collecting was done by Lieut. Rawlins and Capt. C. E. Yate. The Commission left Quetta on 21st Sept. 1884 and travelled via Nushki and Rudbar to the Hamun-i-Helmund. From there their route led by Zagin and Zindijan to Khusan (18-25 Nov.) on the Hari-Rud. They then crossed the Paropamisus Range and halted at Kalla-Bala Morghab from 14th Dec. 1884 to 15th Feb. 1885, returning via the Khushk River to Gulran and Tirphul (4th April). After this the Commission was largely in Persian territory. The specimens are in the British Museum.]

1889.—ST. JOHN, LT.-COL. Sir O.B.—On the Birds of Southern Afghanistan and Kelat. *Ibis*, 1889, pp. 145-180.

[Colonel St. John went to Afghanistan in October 1878 and served there through the Second Afghan War, leaving apparently in April 1881. He was provided by Hume with a skinner and made a good collection of birds which are now in the Hume Collection in the British Museum. The majority were obtained at Kandahar but the area covered extended to Khelat-i-Ghilzai on the north-east and to the Helmund at Girishk on the west.]

1891, SHARPE, R. B. Scientific Results of the Second Yarkand Mission; based upon the collections and notes of the late Ferdinand Stoliczka, Ph.D., Aves. (London, Taylor and Francis).

[Includes a list of various birds collected by Biddulph and Stoliczka in April 1874 in that portion of Afghan Turkestan known as Wakhan and herein listed under Biddulph's name.]

1896, FINN, FRANK.—List of the Birds collected by the Afghan-Baluch Boundary Commission of 1896. *Journal Asiatic Soc. Bengal* 1896, vol. lxv, pp. 566-7.

[A nominal list of a small collection of skins brought back by Dr. F. P. Maynard. Most of the birds were shot by Lieut. F. C. Webb-Ware, 7th Bengal Lancers, round about Sahib Zada Kili a village at the northern end of Shorawuk in Afghan territory. These specimens, some 60 in number, are in the Indian Museum, Calcutta and Dr. Baini Prashad has kindly furnished me with their date.]

1905, CUMMING, J. W. NICOL.—Birds of Seistan, being a list of the birds shot or seen in Seistan by members of the Seistan Arbitration Mission 1904-5. *Journal Bombay Nat. Hist. Society*, vol. xvi, pp. 686-99.

[A small collection of 106 specimens was made by the members of the Arbitration Commission in Seistan and deposited in the Indian Museum, Calcutta.]

1909, WHITEHEAD, LIEUT. C. H. T.—On the Birds of Kohat and Kurram, Northern India. With an introduction by MAJOR H. A. F. MAGRATH. *Ibis* 1909, pp. 90-134, pp. 214-84, pp. 620-23. Reprinted with corrections in *Journal Bombay Natural History Society*, vol. xx, pp. 169-97, pp. 776-99, pp. 954-80.

[Contains much useful information on the Birds of the Sufed Koh which Mr. Whitehead visited in June and July 1906 and again, in company with Major Magrath, in April 1907. Although strictly speaking these officers were not in Afghanistan they were on the border and their observations must illustrate the neighbouring country.]

1919, BAKER, E. C. STUART.—Notes on two collections of Birds from Seistan. *Records of the Indian Museum*, vol. xviii, pt. ii, 1919, pp. 121-34.

[Mr. Stuart Baker reports on two collections from Seistan, amounting to 137 specimens of 79 species, in the Indian Museum, Calcutta. The first collection is that made in 1903-1905 by the Seistan Arbitration Commission (as above). The second containing only 31 specimens was made by Dr. N. Annandale and Mr. S. W. Kemp in December 1918. These are listed in this paper under Dr. Annandale's name.]

1938, MEINERTZHAGEN, COLONEL R.—On the Birds of Northern Afghanistan. *Ibis* 1938, pp. 480-520 and pp. 671-716.

[Colonel Meinertzhagen, accompanied by Mr. Sálim A. Ali entered Afghanistan by the Khyber Pass on 2 April 1937. He travelled via Jalalabad and Kabul to the Unai and Shibar Passes and northwards to Afghan Turkestan and the Oxus Valley by Haibak and Kunduz, returning by much the same route. He reached

India through the Khyber Pass on 1 June. A large and valuable collection of birds, with excellent field notes, was made and the writer finally visited Leningrad in order to complete the working out of the collection properly].

1939, KOELZ, WALTER.—New Birds from Asia, chiefly from India. *Proceedings of the Biological Society of Washington*, vol. lii, pp. 61-82 (June 5, 1939).

[Seventeen new sub-species are described from Afghanistan as the result of collections made in that country by W. Koelz in 1937. If the Indian sub-species described in this paper and what I have seen of Afghan birds from other sources are any guide few only of these new sub-species will stand. It may be inferred from these descriptions that Koelz visited many localities not previously known to any ornithologist and that he made a large collection but nothing else has been published and the war has prevented learning more about it].

Corvus corax lawrencei Hume.

Specimens collected.—♂ ♀ 10 Feb., ♂ ♀ 2 April, ♂ 5 April, ♂ 12 Sept. 1879 Kandahar, ♀ 3 October, ♂ 19 October 1879 Khelat-i-Ghilzai (St. John); ♀ 8 December 1880, ♀ 22 January 1881 Kandahar (Swinhoe); 153 ♀ 23-1-34 Logar (Maconachie); 2 ♂ April Bamian, ♂ ♀ April Ghorband, ♀ April 1937 Doab (Meinertzhagen).

In Northern Afghanistan Meinertzhagen found that the Raven was not abundant anywhere but it was met in pairs or singly almost everywhere, from the Western entrance to the Khyber Pass to Jalalabad and Kabul, high up in the mountain snows at Bamian and down in the hot plains of the Oxus river. Griffith mentions the Raven frequently in his journal in different localities. It is also common in Southern Afghanistan at Khelat-i-Ghilzai and Kandahar. In South-west Afghanistan Cumming records that he saw three at Kuhak on 25 September 1904 and a pair near Hurmal on 18 May 1905, so it would seem to be scarcer in this area.

Swinhoe and St. John were both under the impression that there were two forms of Raven in South Afghanistan, both apparently much the same in numbers and that probably they had a different status. These birds they called *corax* and *umbrinus*. The ten specimen's they collected are in the British Museum and Mr. Kinnear and I after examining them carefully have come to the conclusion that all must belong to one form and that *lawrencei*. It is quite possible that *umbrinus*=*ruficollis* does occur in Afghanistan. It has been recorded from both Sind and Baluchistan. But I cannot help feeling that Swinhoe and St. John were deceived by immature and worn birds (6 of these 10 specimens are immature) of *lawrencei* which are admittedly easy to confuse with *ruficollis*, and this explains their varying conclusions as to the status of the two supposed species in Afghanistan. There are no doubt local movements but the Raven is probably resident in Afghanistan.

Meinertzhagen calls his Afghan birds *subcorax* Severtzow (*Jevotnik*, p. 63. 115), regarding *lawrencei* Hume (*Lahore to Yarkand*, p. 235) as a synonym. If Turkestan and Northwest Indian birds are indeed identical, *subcorax* is the older name as Severtzow says (*S. F.* iii, 423) that it was published in December 1872, whereas Hume's *Lahore to Yarkand* was published in 1873. I have not been able to examine Turkestan birds, but they are usually considered to be *C. corax tibetanus*, and it seems undesirable to disturb a well-established name without more definite proof.

Corvus corone orientalis Eversmann.

Specimens collected.—4 ♂ 1 ♀ May 1937 Haibak (Meinertzhagen).

Meinertzhagen found the Carrion Crow common and breeding at Haibak and Kunduz in Afghan Turkestan, and he collected a small series at the former place. On the Seistan border, on the other hand, Cumming found it a common bird in winter, found frequently near houses. As he states that he shot a specimen on 20 March 1905 his record may perhaps be accepted though not everyone is able to separate the Carrion and Jungle Crows.

Crows of sorts were seen singly and in pairs by Meinertzhagen in the

Upper Kabul Valley near the Unai Pass in late May, at Danaghori and Doab in early May and at Bamian in late April but their identity could not be established. One would expect the Carrion Crow to occur also along the base of the Safed Koh as Whitehead found it breeding on the other side of the range and boundary in the Upper Kurram Valley from 5,000 ft. upwards.

Corvus macrorhynchus intermedius Adams.

Specimens collected.—Sex? Pushut, ♀ Afghanistan (Griffith).

Wardlaw-Ramsey says that the Jungle Crow was the only crow observed in the Hariab Valley where it was very abundant. He found it breeding in the pines at Byan Khel 7,000 ft. in May. Whitehead also says that it breeds very freely on the Safed Koh.

This is, I suspect, the Carrion Crow of Griffith's Journal in which he says many were resorting to the camp at Pushut (23 Feb. 1840) but were very wild from being continuously fired at with matchlocks. At Pushut too (31 March 1840) he remarks on the birds' behaviour on inundated ground and he mentions it again at Bharowl on 7 March 1840. His two specimens, at any rate are Jungle Crows.

This species is doubtless confined to those parts of Afghanistan which are largely Himalayan in the character of their fauna.

Corvus frugilegus frugilegus Linnaeus.

Specimens collected.—2 Sex? 16 January and 16 April 1840 Pushut (Griffith); 2 ♂ 2 ♀ 17-23 January 1881 Kandahar (Swinhoe); 2 ♂ 1 ♀ 1881 Abdul Rahman (C. F. Hutchins); ♂ ♀ 1-9 January 1885 Bala Murghab (Aitcheson); 2 sex? 19-23 March Maruchak, Murghab (Yate); ♀ 13 March 1905 Nad-i-ali, R. Helmund, ♀ 20 March 1905 Kuhak (Cumming); 2 ♂ 15 December 1918 Lab-i-Baring 1,600 ft. (Annandale); ♀ 25 November 1933 Logar 5,700 ft. (Maconachie); ♂ April Kabul 5,800 ft., ♀ April Doab, 2 ♂ April 1937 Doshi (Meinertzhagen).

There is no evidence to suggest that the Rook breeds in Afghanistan and it is evidently an abundant and widespread winter visitor, being recorded from most parts of the country except the higher ranges. Aitcheson says that it was first observed between De-doda and Ibrahim-abad on 28 October (1884) and Annandale was informed in Seistan that it arrived about October. In Kandahar, however, it evidently arrives much later about the middle of January (Swinhoe), January (St. John) and February (Hutton), leaving again in March (Hutton) or in the beginning of April (St. John). Meinertzhagen saw it fairly frequently in flocks round Kabul in early April and there were a few single birds round Doab and Doshi in late April and early May. He also saw a few at Danaghori in early May and a large flock, accompanied by Jackdaws, in the cultivation 20 miles north of Khanabad on 19 May. As in N.-W. India the numbers, distribution and times of arrival and departure of the Rook in Afghanistan no doubt vary according to the character of any particular winter.

Corvus cornix sharpei Oates.

Specimens collected :—♀ 21 November 1884 Khusan, Hari-Rud, ♂ 8 January 1885 Bala Murghab (Aitcheson); Sex? February 1903 Rudbar, R. Helmund (Cumming); ♀ 15 December 1918 Lab-i-Baring 1,600 ft. (Annandale); ♂ 3 November 1933 Logar 5,700 ft. (Maconachie).

So far as is known the Hooded Crow is only a winter visitor to Afghanistan (in spite of the statement in the *New Fauna* i. 32 that it breeds in Afghanistan) and it seems to be fairly generally distributed. At any rate Griffith met it at Jalalabad (21 October 1839), Maconachie at Logar (November), Aitcheson at Bala Morghab (January) and Khusan, Hari-Rud (Nov.). In Seistan it is common and Cummings says that it is found mostly in the tamarisk jungles in twos and threes, though sometimes in large flocks in the open fields. Aitcheson also found it common at the Hamun and Annandale procured his specimens at Lab-i-Baring in December and Rudbar, R. Helmund in February. Both St. John and Swinhoe record the Hooded Crow at Kandahar, the former considering it rare and the latter giving its usual locality as E. banks of the Argendab River.

As there seems to be no record later than February I presume that it leaves the country early and this would explain why Meinertzhagen did not meet with it. It has not been noted later than March 23 in the N.-W. Frontier Province of India.

[**Corvus splendens zugmayeri** Laubmann.

I am unable to trace the authority for including Afghanistan in the range of the House Crow in the *New Fauna*, vol. i, p. 34.]

Corvus monedula soemmeringii Fischer.

Specimens collected.—Sex? no date Kabul, 2 sex? 21 October 1839 Jalalabad (Griffith); ♂ 9 March 1879, ♂ 3 April 1879 Kandahar (St. John); ♀♂♂ 19-29 January 1881 Kandahar (Swinhoe); ♂♂♀ 23 December 1884 Bala-Morghab (Aitcheson); 2 sex? 18-21 March, 1 sex? 25 December, Maruchak, 1 sex? 15 April Karawal Khana (Yate); ♂ 19 January 1934 Logar (Maconachie); 3 ♂ May Haibak, ♀ et pull. May 1937 Kunduz (Meinertzhagen).

The Jackdaw breeds in the north of Afghanistan at Haibak and Kunduz in May according to Meinertzhagen who identifies his specimens from those localities as *soemmeringii.* Elsewhere in the country its status is not very clear and it is perhaps a winter visitor only. Griffith records it in flocks at Pushut on 23 February 1840 and procured specimens at Jalalabad on 21 October 1839 and Kabul. Maconachie met it at Logar in January. Yate collected specimens at Maruchak (March and December) and Karawal Khana (April). Aitcheson also got specimens at Bala-Morghat (December) and found it common in Badghis and on the Hari-Rud and again in some numbers at the Hamun. At Kandahar it is definitely said to be a winter visitor by Swinhoe, arriving about the middle of January and there—as in north-west India—being usually a hanger-on of the Rooks (St. John).

I have only been able to examine four of the above-cited specimens and three of these were immature. As far as they go however they agree well with Kashmir birds though I am not quite certain that *soemmeringii* is the correct name for these.

Pica pica bactriana Bonaparte.

Specimens collected.—2 sex? near Kabul, sex? Arghandi near Kabul, sex? Kandahar (Griffith); sex? 14-23 April 1873 Panjah in Wakhan (Biddulph); sex? 1 May 1879 Byan Khel (Wardlaw-Ramsay); ♂♀ 18 November 1879 Kandahar (St. John); ♂♀ December 1880, ♀ 5 February 1881, ♀ 14 February 1881 Kandahar (Swinhoe); ♀ 20 November 1884 Khusan, Hari-Rud, ♀ 5 December 1884 Koaja-Palounda, Badghis, ♀ 9 December 1884 Ab-i-Kamarra (Aitcheson); 2 sex? 3-7 February Chahar Shamba, Maimanah (Yate); ♀ Shishi River (Maynard); ♀ 1 Sept. 1933 Kabul (Maconachie); 3 ♂ May Haibak, ♀ et pull. Kunduz May 1938 (Meinertzhagen).

The Magpie is resident in Afghanistan and widely but by no means generally distributed. Its known distribution is as follows. The traveller on the road from India and Peshawar will not find it at Jalalabad or until he reaches about 10 miles from Kabul and from there it extends to the Unai Pass (and no doubt further) on the south west of Kabul and to the Ghorbund Valley on the North. Meinertzhagen also met with a single pair at the south end of the Dar-e-shikari Gorge.

It is particularly abundant south-east of Kabul from Byan Khel and the Hariab Valley (Wardlaw-Ramsay) to Ghazni (Vigne) Girishk (Hutton) and Kandahar right up to the boundary at the Khojak Pass (Swinhoe), occurring alike in gardens, groves and wooded hills.

In the tamarisk jungles of Seistan it is less numerous (Cumming).

Along the northern boundary of Afghanistan the above records from Khusan (Hari-Rud), Koaja-Palounda in Badghis, Ab-i-Kamarra and Chahar Shamba (Maimanah) show that it occurs very generally while Meinertzhagen saw it in the gardens of Haibak. Biddulph obtained it at Panjah in Wakhan.

All the Magpies which I have been able to examine from Afghanistan (10 in number) belong to the same form *bactriana*, which is found both in Northern Kashmir territories and in Baluchistan. It is possible, however, that another race remains to be recognised. Aitcheson particularly draws a distinction between his specimen from Khusan which he calls *leucoptera* and his other two birds from Koaja—Palounda and Ab-i-Kamarra which he considers true *pica.* He seems, however, to have been merely misled by the difference between adult and immature birds. But it should be remembered that Meinertzhagen said that the birds at Haibak (where from their caution and wildness he was unable to obtain specimens) seemed to be finer birds, larger, longer tailed and certainly in better plumage than the bold scavengers of the neighbourhood of Kabul. The point should be borne in mind.

Meinertzhagen found a nest with 6 eggs in the Legation garden at Kabul on 11 April and found family parties on the wing in the Ghorband valley at the end of May. At Haibak birds were sitting at the end of May.

[**Dendrocitta vagabunda** (Latham).

Afghanistan is included in the range of the Indian Tree Pie in the *New Fauna,* vol. i, p. 49 but I find no authority for this].

[**Garrulus lanceolatus** Vigors.

The Lanceolated Jay is fairly plentiful in the Ilex scrub of the Kurram Valley occurring up to 8,000 ft. and Major Magrath saw a flock of about forty individuals near Peiwar 7,000 ft. in April 1907. It must certainly therefore occur across the boundary line in Afghanistan though it has not yet been recorded there, unless the 'Jay Small sized' of Griffith's Journal seen at Bala Chugur Serai on 5 March 1840 was this bird. A specimen from Jagdulla 7 November is given in Griffith's MS. list but it is not in the British Museum Collection].

Nucifraga caryocatactes multipunctata Gould.

Wardlaw-Ramsay attributes to this form three Nutcrackers which he saw one day on the Peiwar Kotal (*Ibis* 1880, p. 62). The attribution was no doubt correct as it was this form which Whitehead found in the Kurram side of the Safed-Koh, and which is common further north in Hazara.

Pyrrhocorax pyrrhocorax himalayanus (Gould)

Specimens collected.—2 ♀ 24th Nov. 1880, ♂ ♀ 4-19 January 1881 Kandahar (Swinhoe); 3 ♂ 2 ♀ Abdul Rahman (F. Hutchins); ♀ 9 September 1933 Katakhak 9,750 ft., ♂ 14 Sept. 1933 Head of Saighan Nala 11,000 ft. (Maconachie); ♂ April Paghman, ♀ April Ghorband, 2 ♂ April Bamian, 2 ♂ April Akrobat, ♂ ♀ April 1937, Doab (Meinertzhagen).

The Red-billed Chough breeds in that part of the Hindu Khush which has been partially explored from the direction of Kabul. Here, according to Meinertzhagen it is nowhere abundant, but always to be found singly or in pairs, where the country is suitable, between 12,000 ft. and 3,000 ft. It is interesting to recall the fact that Griffith found it very abundant in Sept. 1839 and August 1840 at Bamian where Meinertzhagen met with a flock of 40 birds nearly a century later on 25 April 1937. The latter met parents with full-fledged young on a cliff face at 8,300 ft. in the Ghorband Valley on 24 May.

From this area doubtless come the large flocks which appear in winter on the plateau of Southern Afghanistan about Kandahar (Swinhoe, St. John). Hutton says that they arrive in November and leave about March and he adds that at Girishk in the Helmund they arrive in hundreds about sunset to settle amongst the swampy beds of the river, where one may presume them to roost.

Pyrrhocorax graculus forsythi Stoliczka.

Specimens collected.—2 ♂ 3 ♀ Melkarez (Hutchins); ♂ 15th Sept. 1933 Khalachan 9000 ft. (Maconachie).

In addition to the above records it will be remembered that Whitehead found the Alpine Chough fairly well distributed in summer along the upper slopes of the Safed Koh above tree-limit.

The wing of Maconachie's specimen—which is the only one I have seen—is in moult and cannot therefore be measured but the other measurements, viz. bill from skull 39, tail 171, tarsus 42.5 mm., suggest that it should be attributed to the large Himalayan race.

Parus major ziaratensis Whistler.

Specimens collected.—♂ 16 March, ♂ 30 March 1879 Kandahar (St. John); ♀ 9 January 1881 Kandahar (Swinhoe).

According to St. John and Swinhoe the Grey Tit is common and resident about Kandahar and their specimens in the British Museum belong to this form. Koelz also attributes to it his specimens from Kandahar and also from Herat.

Parus major bokharensis Lichtenstein.

Specimens collected.—2 ♂ 6 December 1884 between Palounda and Karrez-darra (Aitcheson); 5 ♂ 2 ♀ 12-13 May 1937 Haibak 3,000 ft. (Meinertzhagen).

Meinertzhagen only met with the Grey Tit in the orchards and gardens of Haibak where it was common and breeding. I have not been able to examine Aitcheson's two specimens but they presumably belong to the same form.

In 1937 Koelz collected a series of Grey Tits at Balkh on September 18-19 and November 28-30 and a specimen at Tashkurghan on 4 Sept. One would have expected these to belong to the same form, *bokharensis* but Koelz has named them as a new sub-species *Parus m. meinertzhageni* (Proc. Biol. Soc. Washington vol. lii (June 5, 1939) p. 61).

[**Parus major intermedius** Zarudny.

Afghanistan is included in the range of this tit in the *New Fauna* (vol. i, p 76). I can however find no warrant for this.]

Parus major caschmirensis Hartert.

Specimens collected.—2 sex? Afghanistan (Griffith); ♂ 30 April 1879 Byan Khel (Wardlaw-Ramsay).

Wardlaw-Ramsay found the Grey Tit very common and breeding in May and June in the Hariab Valley 7,000-8,000 ft. about Byan Khel. He saw a nest with young on 1st May. The single specimen from there in the British Museum appears to belong to this race. Griffith notes in his Journal that tits were seen at Bharowl on 7th March and at Bala Chuquar Serai on 5 March 1840. His two specimens in the British Museum—to which perhaps these records apply—are poor in condition but they also seem to belong to this race. Koelz collected 6 tits at Jalalabad in December, 2 at Daulatshah and two at Paitak in June 1937. To these also he gave a new name *Parus major declorans* (*loc. cit.*). For geographical reasons one would expect these and the Byan Khal birds to belong to the same form. It is clearly desirable that the Grey Tits of Afghanistan should be studied critically as soon as more material is available.

[**Parus palustris korejewi** Zarud. and Harms.

In the *New Fauna* (vol. i, p. 82) this Marsh Tit is said to occur in Afghanistan but I can trace no record to that effect].

Lophophanes melanolophus (Vigors).

Specimens collected.—♂, sex?, 22 April, ♂ 5 May, ♂ 16 May 1879 Byan Khel (Wardlaw-Ramsay).

The Crested Black-Tit is only known from the eastern border of Afghanistan where Blanchard obtained it in the Gardez Forest in May 1935 and where Wardlaw-Ramsay found it common in the Hariab Valley at 7,000-8,000 ft. It was building in the pine woods about Byan Khel in May and June. Whitehead says it is very common on the Safed Koh from 6,500 ft. to tree-limit.

Lophophanes rufonuchalis rufonuchalis (Blyth).

Specimen collected.—sex? Kabul (Griffith).

The Simla Black Tit, like the last species, is only known from the eastern border of Afghanistan. Blanchard collected specimens in May 1935 in the Gardez Forest and these were named *Parus rufonuchalis blanchardi* by Meinertzhagen (*Bull. B.O.C.* lviii (1938) p. 95) but the form does not appear to me to be separable. Wardlaw-Ramsay found it common in the Hariab Valley and breeding about Byan Khel 7,000 ft. in May. He observed it up to 10,000 ft. on the Safed Koh.

Ægithaliscus leucogenys (Horsfield and Moore).

Specimens collected.—2 sex? Afghanistan (Griffith).

Griffith appears to be the only observer who has met with the White-cheeked Tit in Afghanistan. He records it at Bharowal above Bala Chaquar Serai at 4,000 ft. where it was in pairs in the woods in March and April. This is the type-locality. Whitehead found it breeding freely on the Peiwar spur from 6,000 ft. to 8,000 ft. in March, April and May.

Remiz coronatus (Severtzow).

Specimens collected.—3 ♂ 19 April, ♂ 23 April 1885 Tirphul (Aitcheson).

These specimens provide the only records of the Penduline Tit for Afghanistan but as the species is a fairly regular winter visitor to N.-W. India from Peshawar to Sind it is probably not uncommon on passage in Afghanistan.

Sitta caesia cashmirensis Brooks.

Specimens collected.—2 ♀ Otipore (Griffith), ♂ 22 April 1879 Byan Khel (Wardlaw-Ramsay).

This Nuthatch—(which he first recorded as *Sitta cinnamoventris* while Griffith labelled his specimens *S. castaneoventris*)—was found by Wardlaw-Ramsay to be common at Byan Khel 7,000 ft. and on the Peiwar Kotal where it was breeding in May. All the young had flown by the middle of June. Whitehead also recorded it as common on the Safed Koh. Griffith appears to have obtained his specimens about 10-14 April 1840 to judge by his Journal.

Wardlaw-Ramsay labelled his specimen with the manuscript name *Sitta hariabica* (which does not however appear to have been published) and though they exhibit no colour differences, this specimen and two collected by Venning over the Afghan boundary in Zhob have certainly stronger and longer beaks than true *cashmirensis*. Further specimens are required to verify this supposed racial difference.

Sitta leucopsis leucopsis Gould.

Specimens collected.—♂ 21 May 1879 Byan Khel, sex? 20 June, Juv. 21 June 1879 Peiwar Kotal (Wardlaw-Ramsay).

Wardlaw-Ramsay found the White-cheeked Nuthatch rather common on the Peiwar spur of the Safed Koh from 7,000 ft. (the lowest limit of pine growth) upwards. He saw an occupied nest on 21 May and shot a newly fledged bird on 21 June near the Peiwar Kotal. Whitehead records it as the common Nuthatch of the Safed Koh.

It also occurs in the Gardez Forest where Blanchard met it in May-June 1935.

Sitta neumayer tephronota Sharpe.

Specimens collected.—1 sex? Kandahar (Griffith); ♂ ♀ 18 April 1881 Kandahar; ♂ 5 December 1884 between Kushk and Palounda, ♂ ♂ ♀ 6 December 1884 between Palounda and Karezdaria, ♂ ♂ 3 May 1885 Shore-Kaltegai (Aitcheson); 2 sex? 18 May Darband-i-Kil Rekhta, Murghab (Yate); sex? 13 July Sufed Sir 7,500 ft., ♀ 17 September Kamard 5,600 ft., sex? 16 Sept. 1933 Kotal Kabuchi 8,500 ft. (Maconachie); ♂ ♀ 9 April Paghman 8,000 ft., ♂ ♀ 15 April Ghorband 5,000 ft., 2 ♂ 22-24 April Bamian 8,500 ft., ♂ ♀ 26 April 1939 Akrobat 9,000 ft. (Meinertzhagen).

The Rock Nuthatch is very generally distributed as a resident bird in Central and Southern Afghanistan, so much of the country being suited to its needs. In the south it is particularly common about Kandahar, occurring in the neighbouring hills and the rocks behind the old city (Hutton, St. John, Swinhoe). St. John found a nest in a hole in the wall of a small mausoleum by the River Arghandab in April.

Griffith mentions it in his journal as seen at Bamian 3-6 October 1839 and at Tazin on 10 October 1839 and Maconachie and Meinertzhagen found it in the Kabul area in the places represented by the above localities. The latter has some notes on the behaviour of birds at two nests in April in the Ghorband Valley at 8,200 ft. Further west Aitcheson in collecting his specimens notes that this species is a very common and characteristic bird of the sandstone rocks of the Badghis country. I have been unable to examine any of his specimens to verify that they belong to this race

Sitta neumayer subcœruleus Meinertzhagen.

Specimens collected.—2 ♂ 6 ♀ 15-17 May 1937 Haibak 3,000 ft. (Meinertzhagen).

In his journey northward to the valley of the Oxus Meinertzhagen noted that *S. n. tephronota* was not observed north of the Dar-e-Shikari gorge at 7,000 ft. After a gap of about a hundred miles he found Rock Nuthatches again on the bare earth cliffs near Haibak, but these birds belonged to another race *subcoeruleus*. Here it was noticed that after the young were fledged two families would unite into one huge party of 15 or 16 individuals.

Argya caudata huttoni (Blyth).

Specimens collected.—♂ ♂ 18-30 Dec. 1880 Kandahar (Swinhoe), ♂ 26 April 1905 Kuhak (Cumming).

The Common Babbler is apparently confined to the South of Afghanistan and there it is a resident species. It is only recorded from Kandahar where it is a garden bird but not very common (Swinhoe: St. John) and the tamarisk jungles of the Helmund (St. John) and Seistan (Cumming) where it is said to be abundant. Kandahar is the type locality of this race.

Hypocolius ampelinus orientalis Koelz.

Specimens collected.—6 specimens 21-24 October 1937 Kandahar (Koelz).

The above specimens provide the only records of the Grey Hypocolius for Afghanistan and on them Koelz based his new race *orientalis* (Proc. Biol. Soc., Washington, vol. 52 (5 June 1939), p. 64). As neither Swinhoe nor St. John met with this bird at Kandahar I find it difficult to believe that Mr. Koelz's specimens were not on passage. The characters on which his new race is based are not impressive.

Microscelis psaroides psaroides (Vigors).

Specimens collected.—2 sex? Chughur Serai (Griffith).

Griffith remarks in his diary that the Black Bulbul was first seen on the Chughur Pir on 19 March 1840. A few were seen on 20 March around a village called Pillipote, favoured for its zaitoon trees.

Molpastes leucogenys leucotis (Gould).

Specimens collected.—♂ ♂ ♀ 8-18 Dec. 1880, ♂ ♀ 19th February 1881 Kandahar (Swinhoe); 2 ♂ 1 ♀ 1881 Kandahar (Hutchins).

Swinhoe and St. John record that the White-eared Bulbul is very common about Kandahar up to an altitude of 6,000 ft. or thereabouts. It is particularly common in the city where Swinhoe caught a half-fledged bird as early as 11 March. As Koelz obtained it at Farah and Cumming observed it just over the Afghan-Persian border at Nasratabad it probably occurs generally in Southern Afghanistan. A resident species.

Koelz separates his Farah and Kandahar specimens as *Molpastes leucotis farahensis* (Proc. Biol. Soc. Washington vol. 52 (5 June 1939) p. 64) but the Kandahar series in the British Museum agree with Indian birds.

In the *New Fauna* (vol. i, p. 390) *M. l. leucogenys* is stated to occur in Afghanistan. This however appears to be a slip for this race which is omitted.

Molpastes leucogenys humii Oates.

Specimen collected.—♂ 31 May 1937 Jalalabad (Meinertzhagen).

Meinertzhagen records that this race of White-cheeked Bulbul was common and breeding at Jalalabad at the end of May.

Certhia himalayana limes Meinertzhagen.

Specimens collected:—2 sex? Pushut, 2 sex? Jalalabad (Griffith); 2 sex? 19 June 1879 Peiwar Kotal (Wardlaw-Ramsay); 3 ♂ 2 ♀ Kandahar (Hutchins).

In addition to the above specimens and Griffith's statement in his Journal that he met a Tree-Creeper at Bharowal on 10 April 1840, the Himalayan Tree-Creeper was recorded by Wardlaw-Ramsay as common enough on the Peiwar Spur and on the adjoining slopes of the Safed Koh, where it was evidently breeding in June. This is confirmed by Whitehead who says it breeds there in a zone from 7,000 to 9,000 ft.

Koelz has named a race *C. h. cedricola* (Proc. Biol. Soc., Washington, vol. 52 (5 June 1939) p. 65) from a composite series of 4 December birds from Jalalabad and 6 June birds from Kail, Ferajghan Pass and Sirotai, one of his Jalalabad specimens being named as type. There the Tree-Creeper is evidently a winter visitor and I do not see from the description how his new race is distinguishable from Griffith's Pushut and Jalalabad specimens which are clearly *limes*.

The statement in the *New Fauna* (vol. i, 431) that *C. h. taeniura* occurs in Afghanistan is evidently merely due to confusion with this race. All the Afghan specimens examined have too short bills for the Turkestan race.

Tichodroma muraria (Linnaeus).

Specimens collected:—3 sex? Jugdulluck, Jalalabad and Pashat Fort (Griffith); ♂ ♂ 18 December 1880, ♂ 22 December 1880, ♀ 24 December 1880, ♂ 30 January 1881 Kandahar (Swinhoe); ♀ 5 December 1884 between Kushk and Palounda, ♂ 26 December 1884, ♂ January 1885 Bala-Morghab (Aitcheson); ♀ 20 December 1905 Peshawaran (Cumming); ♂ 9 September 1933 Katakhak 9,750 ft., ♂ 26 November 1933, sex? 23 December 1933 Logar 5,700 ft. (Maconachie); 4 ♂ 2 ♀ 8-9 April Paghman, ♂ 22, April 1937 Bamian (Meinertzhagen).

It is quite possible that the Wall-Creeper breeds at high altitudes in the Hindu Khush as suggested by Maconachie's specimen from Katakhak 9,750 ft. in September. It certainly breeds, at any rate, on the Safed Koh where Whitehead found a family party at 15,000 ft. on 12 July. It is a common winter visitor to lower levels in Afghanistan. Griffith obtained it at Jugdulluck [12 October 1839*], Pashat [16 February 1840] and Jalalabad and Maconachie at Logar (November and December). Aitcheson procured it between Kushk and Palounda (December) and at Bala Morghab (December and January). Meinertzhagen found it most abundant in the Paghman Valley at 8,000-8,500 ft. in early April and a few were seen in the Bamian Valley in mid-April. These birds were probably on passage.

Towards Kandahar it is a very common winter visitor (Hutton, Swinhoe) and St. John remarks that it may frequently be seen on the ramparts of the town and the sun-dried brick walls of the province generally. On more than one occasion he saw it flitting about his half-opened window like a great butterfly. At Kandahar Swinhoe last saw it on 9 February.

In South-west Afghanistan the country is less suitable and Cumming only met with it in Seistan on two occasions, at Nad Ali on 7 March 1903 and at Peshawaran on 20 December.

Troglodytes troglodytes subsp.?

Specimens collected:—3 sex? 26 January 1 February Chahar, Shamba, Maimanah (Yate); sex? 20 December 1933 Chahiltan 5,900 ft., ♀, sex? 6 January 1935 Logar 5,700 ft. (Maconachie); ♂ 8 April 1937 Paghman 7,500 ft. (Meinertzhagen).

There is a good deal of difficulty about the identification of Afghan wrens. The three specimens obtained by Yate in Maimanah are, according to Scully, rather deeply coloured birds whereas the three specimens collected by Maconachie seem paler and greyer (thereby agreeing with some Gilgit specimens in the British Museum) than true *neglectus* from Kashmir. Wrens are very variable birds and it does not do to revise their classification on a few specimens but it is quite possible that these greyish birds represent a separable race. If so it seems probable that the name available for them is *Anorthura magrathi* Whitehead, *Bull. B.O.C.*, xxi. (1908), p. 19. This name was given by Whitehead to the wren which he said was found commonly on the Safed Koh from 8,000 ft. upwards to the very summit of the range, chiefly in the juniper scrub. Unfortunately his two specimens, including the type, are juveniles and it is not possible therefore to say whether they belong to *T. t. neglectus*, as stated in the *New Fauna* (vol. i, p. 447) or whether they are of the same sub-species as these greyish Afghan birds.

Meinertzhagen's specimen from Paghman, which was the only wren he met, could not be matched with anything in the Berlin and Leningrad Museums and is paler, less red than 80 birds examined from all over Turkestan and the Pamirs. It is said to be nearer *tianschanicus* than anything else but might possibly belong to a new form.

It is quite likely of course that two forms occur in Afghanistan.

Cinclus pallasii tenuirostris Bonaparte.

Specimens collected.—Juv. 5 October Iskar, Afghan Turkestan, 2 sex? 8 October Deh Tang, Ghorband (Yate); ♀ juv. ♂ ad. 13 July 1933 Khawak Chapchi (Maconachie); 4 ♂ 2 ♀ 8-12 April Paghman 8,000 ft., 3 ♂ 3 ♀ 16-18 April Ghorband 8,300 ft., Juv. 23 May 1937 Shibar Pass 8,500 ft. (Meinertzhagen).

Meinertzhagen found the Brown Dipper common on the Paghman River and in the Ghorband and subsidiary valleys. Birds were building on 12 April. It was not observed north or west of the Shibar Pass and the only other records for Afghanistan are furnished by the specimens listed above and the specimens listed by Koelz from the Kargasi Pass, Sanglech, the Minjar Pass and Paghman in June, July and August on which he bases his subspecies *C. p. kargasiensis* (Proc. Biol. Soc. Washington, vol. 52 (5 June 1939) p. 65).

Whitehead however states that it occurs along the larger streams of the Safed Koh up to 9,000 ft. but is scarce. He shot a strong flying young bird on 27 June.

Cinclus cinclus leucogaster Bonaparte.

Specimens collected.—2 ♂ 1 ♀ 16-17 April Ghorband 8,200 ft., ♀ 25 April Bamian 11,000 ft. (Meinertzhagen).

Meinertzhagen only met the White-bellied Dipper in these two localities and in a higher zone than the Brown Dipper from 8,200 ft. to 11,000 ft., though the two species overlapped about 8,200 ft. He has an interesting note on the habits.

(*To be continued.*)

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*These dates are taken from Griffith's journals.

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. St. J. Macdonald.

(*With* 16 *text-figures*)

Part VII

(*Continued from page* 354, *of this volume*)

Other Sporting Fish and How to catch Them.

Carnatic Carp (1), Chitrahtu (2), Katli, Bokar (3), Jerruah (4), Olive Carp (5), White Carp (6), Black-spot (7), Malabar Carp (8), Rohu (9), Kala Banse (10), Mirgil (11), Cirrhina cirrhosa (12), Catla (13), Indian Trout (14), Barilius tileo (15), Chilwa (16).

I have listed in this chapter all the common fish taken on rod and line in Burma and India; giving the familiar or anglicised names followed by the ichthyological names, with a description of each fish.

Actually these fish should be dealt with under two separate divisions—game and semi-game fish, as a large number of those listed are taken while fishing for mahseer or other larger varieties of carp, and to which it is not worth devoting much time when the larger species are available. I mean the smaller carp such as White carp, Olive carp, etc.

I have appended short notes to the fish that are in my opinion worth catching or devoting one's spare time to.

Under Rohu, Murral, and Seetul, for instance, will be found methods of fishing not previously mentioned in any book, but quite worth a trial. The reader will find sufficient detail in this chapter to help him to find and catch the commoner fishes: but I would ask him to bear in mind, that, to what Thomas devoted 78 pages in his book 'The Rod in India', I have condensed in a meagre 19.

The text-figures were originally printed in Day's 'Fishes of India'. Fourteen were reproduced by Messrs Shaw and Shebbeare in their 'Fishes of Northern Bengal'. The blocks used by them were kindly loaned by the Royal Asiatic Society of Bengal to whom the author and the Bombay Natural History Society wish to express their sincere thanks.

The Mahseer I have dealt with fully in the Chapter on Burma, so will not include it again in this list.

SUB-CLASS: *TELEOSTEI.* Bony Fishes.

Order: **Physostomi**

The fresh water fishes of India belong to the Sub-Class of Bony fishes (Teleostei). Most belong to the family of Carps (Cyprinidae) and the order of Sheat-fishes (Siluroidea).

The Carps have no teeth in the mouth, but have scales on the body. The Sheat-fishes have no scales, but have teeth in the mouth.

Family: *CYPRINIDAE.*

This family is prominent in the absence of any sort of peculiarities, but the members are familiar to most people. A great majority of Indian freshwater fishes belong to this family. They have scales on the body but the head is naked. Frequently barbels are present, but no adipose fin is to be found. There is only one dorsal fin with its first few rays closely adpressed and unbranched; the last unbranched ray is sometimes serrated along its hinder margin. Mouth is toothless, but there are teeth in the throat known as Pharyngeal teeth, which may be arranged in one, two, or more series. This family comprises the Carps, Mahseers, Barbels, etc., all of which are game and sporting fish.

Genus: **Barbus**

1. **CARNATIC CARP: Barbus (Puntius) carnaticus** Jerdon.

Vernacular names:—*Poaree candee, Saalcandee, Shellee*, Tamil; *Gid-pakke*, Canarese; *Giddi-kaoli*, Hind.

D. 12 $\left(\frac{4}{8}\right)$; P. 15; V. 9; A. 7 $\left(\frac{2}{5}\right)$; C. 19; L. 1·32.

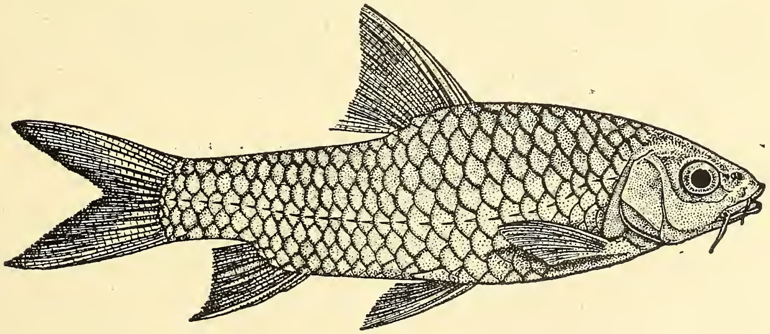

Fig. 1.—*Barbus (Puntius) carnaticus* Jerdon.

Rivers along the bases of Nilghiris, Wynaad and South Canara hills are the common habitat of this fish. The dorsal profile is more connex than the ventral. The upper jaw is larger and the lower labial fold is interrupted. There are two pairs of barbels, both being thin and shorter than the eye. The dorsal fin commences anterior to the insertion of the ventrals and midway between the snout and the base of the caudal fin; it is about ¾ as high as the body. Its last undivided ray is a strong and smooth spine, as long as the head in the immature specimens, but sometimes longer in the adults. Pectoral fin is as long as or slightly longer than the head while the anal fin reaches the caudal. The lateral line is complete and there are $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin. The colour of the fish is greenish-brown along the back, becoming dull white glossed with gold on the sides and beneath. The fins are grayish and the eyes are golden. This fish runs to 25 lbs and frequents the same water as the mahseer; is taken best on fly. To the inexperienced eye it may be mistaken for a mahseer. They are caught in quiet runs and eddies and back waters between runs, more than in white water of the rapids themselves as in the case of mahseer. Under trees, near sunken logs or swirls, round rocks, are the specially beloved places of this fish. The flies they take best are size No. 5 or 6 in hooks and black or dark. An all peacock fly is probably most killing.

2. **CHITRAHTU. Barbus (Puntius) chillinoides** McClelland.

Vernacular name :—*Chit-rah-too*, Punj.

$$\text{D. } 10\text{-}11 \left(\frac{3}{9\text{-}8}\right);\ \text{P. } 17;\ \text{V. } 9;\ \text{A. } 7\ (2/5);\ \text{C. } 19;$$

$$\text{L. l. } 32\text{-}35.$$

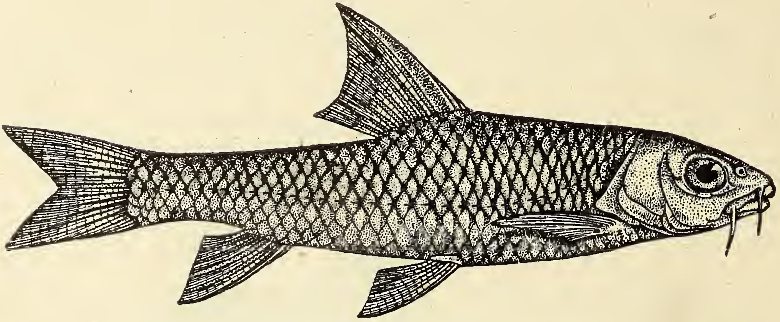

Fig. 2.—*Barbus* (*Puntius*) *chillinoides* McClelland.

This fish is found along the Himalayas as far to the east as Assam, and also in the Ganges. It attains about $2\frac{1}{2}$ ft. in length. The body is rather elongated so that the dorsal and abdominal profiles are about equally convex. The upper jaw is slightly the longer and the snout overhangs the mouth which is directed forwards. The lips are moderately thick, the lower with a continuous transverse fold, but without a lobe. There are two pairs of barbels which are of about the same length and equal to $1\frac{1}{2}$ diameter of the orbit. The dorsal fin commences about midway between the tip of the snout and the base of the caudal fin. Its last undivided ray is osseous, very strong and entire. The anal fin reaches the base of the caudal which is deeply forked. The lateral line is complete and there are three rows of scales between it and the base of the ventral fin. The colour of the fish is golden above becoming silvery beneath. The margins of the scales are provided with numerous fine black dots. A black mark is present behind the opercle. The fins are reddish,

3. **KATLI. Barbus (Lissochilns) hexagonolepis** McClelland.

Vernacular names :—*Bokar* and *Boolooah* Assam; *Katli*, Nepal.

D. 4/9 ; P. 1/13-15 ; V. 1/8 ; A. 3/5 ; C. 19 ; L. I. 22-31.

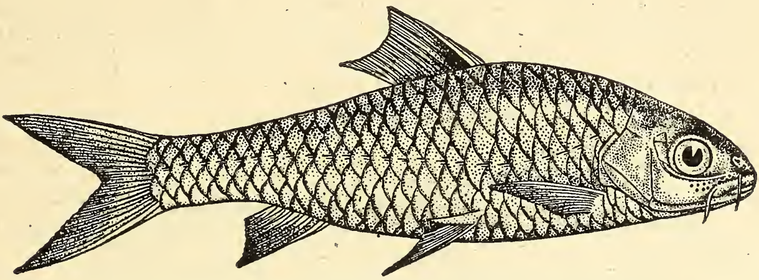

Fig. 3.—*Barbus* (*Lissochilus*) *hexagonolepis* McClelland.

This is the Bokar of the Assamese and Katli of the Nepalese. It is also known as the Snub-nosed Mahseer and is perhaps the commonest large-scaled Barbel of Assam and of the Eastern Himalayas. Though Shaw and Shebbeare do not attribute a good size to this fish, it is known to grow to a fairly big size. Moreover according to Mr. S. J. Duncan[1] this is the 'Mighty Mahseer of the region traversed by him and that it was found in almost all the rivers of the Hills'.

This is a beautifully coloured fish, though the colouration might vary considerably according to the nature of the water inhabited by the fish. According to Hora[2] "The dorsal surface of the head and body was bottle green, the lateral band above the lateral line was yellowish brown followed by an area of King's blue colour which was replaced below by silvery white. The edges of the scales were marked with light bluish neutral tint. The tip of the snout was stone green, and the barbels had a neutral tint. There were two oval patches of a light yellow colour before and behind the eyes; the iris was yellowish brown and the gill cover light alizarine pink. The dorsal fin had a citron green colour, while the pelvic, anal and greater part of the pectoral and caudal fins were of a slate grey colour. There was a patch of buff colour on the pectoral and the margin of the caudal was of a light greenish neutral tint.' In general form this fish is similar to *B.* (*Tor*) *mosal*, but the head is relatively shorter and broadly rounded in front. The most conspicuous feature of the head is the possession of several rows of horny tubercles on the sides in front of and below the eyes. Shaw and Shebbeare noted that the habits of this fish are 'very similar to those of the Mahseer. As a sporting fish there is nothing to choose between them, weight for weight. It is unfortunate that, as both take the same lures, and are found in the same water, the smaller species is often taken on much too heavy tackle which does not give him a chance to show his power'. I have taken these fish in Nepal as far west as the Girwa River. See 25-pound Chocolate Mahseer in Chapter on Burma, caught by the author, which has been identified by Hora as the Bokar.

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[1] Hora, S. L., Game Fishes of India, xi, 4. *Journ. Bombay Nat. Hist. Soc.*, XLII, p. 86 (1940).

[2] Hora, S. L., *id.*, *ibid.*, p. 84 (1940).

4. **JERRUAH. Barbus (Puntius) chagunio** (Ham.)

Vernacular names :—*Jerruah*, Beng.; *Chaguni*, Behar; *Pootee keintah*, Assam

D. 3/8; P. 15; V. 9; A 3/5; C. 19; L. 1. 44–47.

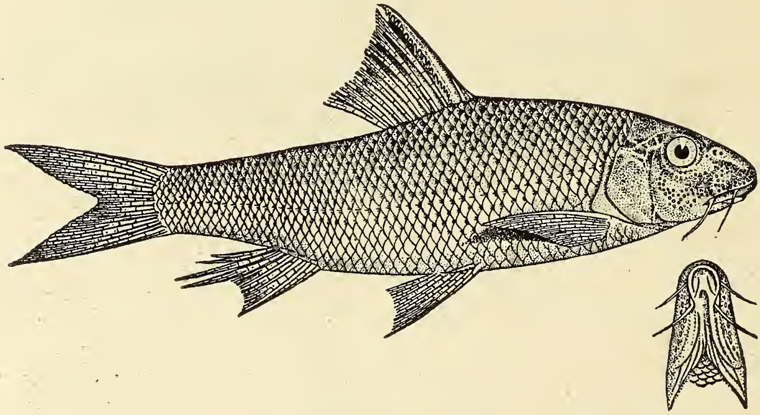

Fig. 4.—*Barbus* (*Puntius*) *chagunio* (Hamilton). Male

This fish inhabits clear streams and rivers in the foot-hills, Terai and Duars. According to Day it attains at least 18 inches. The upper profile in front of the dorsal fin is more arched than the lower. The snout is bold and is covered with sunken pores which in males are more strongly marked and more sharply defined. There are two pairs of barbels which are rather longer than the orbit. The dorsal fin arises midway between the end of the snout and the base of the caudal fin. Its undivided ray is osseous, strong with coarse teeth. Some of the last few anal rays are elongated in the males and the species exhibits marked sexual dimorphism. *Colour.*—The fish is silvery with a faint pinkish tinge. A black spot is present at the base of each scale on the upper three quarters of the body. Fins are yellowish, dorsal and caudal with a suffused sub-marginal band of red touched with black. Pelvics and anal are tinged with red. The male is more brilliant throughout and the black fin tips are more marked.

5. **OLIVE CARP. Barbus (Puntius) sarana** (Ham.)

Vernacular names :—*Punjella*, Tam.; *Giddi-kaoli*, *Durhie* and *Potah*, Hind.; Gid-pakke, Canarese; *Kanaka*, Telugu; *Sarana*, Ooriah and Bengali; *Jundoori*, Punj.; *Pop-pree* and *Kuh-nah-nee*, Sind; *Sen-nee*, Assam; *Nga-khon-mah-gyr* and *Nga-chong*, Burmese.

D. 3/8; P. 15 : V. 9; A. 3/5; C. 19; L. 1. 32–34.

This fish inhabits clear streams of the foot hills, Terai and Duars, also ponds and borrow pits.

The body is deep and moderately compressed. The dorsal profile is elevated. No pores are present on the snout. The lower labial fold is interrupted. There are two pairs of barbels; the rostral is as long as the orbit while the maxillary is slightly longer. The dorsal fin arises rather nearer the snout than the base of the caudal fin, and opposite the insertion of the ventrals. The undivided dorsal ray is osseous, strong in the adult and finely serrated posteriorly. There are 3½ to 4 rows of scales between the lateral line and the base of the ventral fin. *Colour*—silvery, darker above. Usually a golden blotch is found on the opercle and sometimes a small dark spot is also seen behind the gill-opening. The young individuals have a faint black spot covering 25th to 28th scales on the lateral line. The fins are greyish-white with the caudal, pelvic and anal fins tipped red.

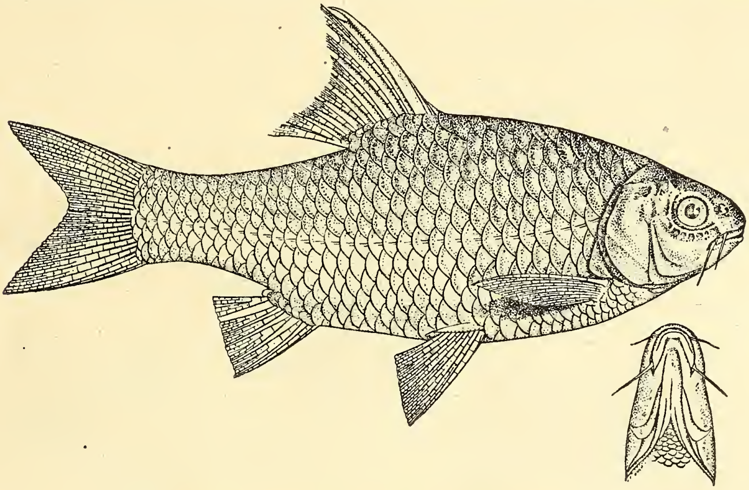

Fig. 5.—*Barbus* (*Puntius*) *sarana* (Hamilton).

6. **WHITE CARP. Barbus (Puntius) curmuca** (Ham.)

D. 12 (3/9); P. 16; V. 9; A. 8 (3/5); C. 18; L. 1. 41.

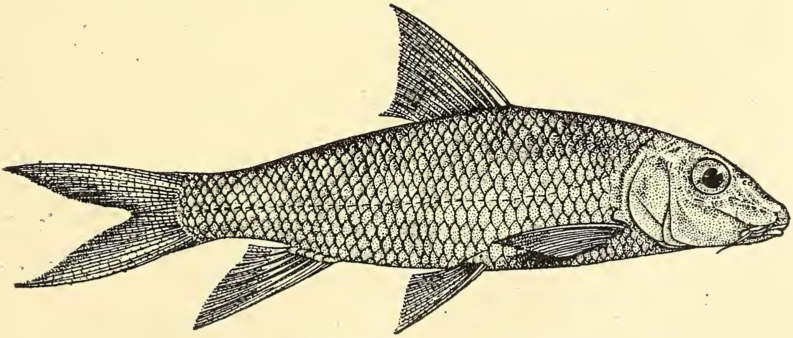

Fig. 6.—*Barbus* (*Puntius*) *curmuca* (Hamilton).

A fish attaining four feet in length, it is found along the Western Ghats of India. The dorsal profile is more convex than the ventral. The head is rather compressed with a conical snuot and a transversely concave interorbital space. In the adults, a band of open pores may be present running from the preorbital along the cheek. There are two pairs of maxillary barbels, the lower as long as the eye while the upper is only half as long. The dorsal fin arises in front of the ventrals and is rather nearer to the snout than to the base of the caudal fin; its last undivided ray is weak and articulated. The lateral line is complete, with 3½ rows of scales between it and the base of the ventral fin. The caudal fin is deeply forked and its lobes are pointed. *Colour*.—The fish is silvery which is lighter on the sides and beneath. The tips of the caudal fin are blackish. In the young, however, the middle third of the caudal fin is orange and tipped with black.

7. **BLACK SPOT. Barbus (Puntius) filamentosus** (Cuv. & Val.).[1]

D. 11 (3/8); P. 15; V. 9; A. 7 (2/5); C. 19; L. 1. 21.

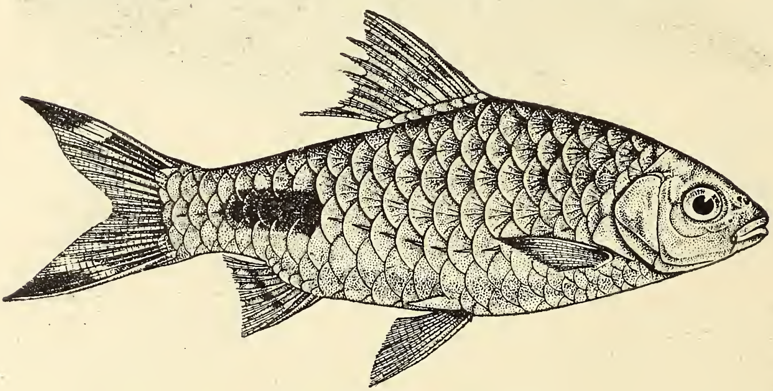

Fig. 7.—*Barbus* (*Puntinus*) *filamentosus* (Cuv. & Val.).

This fish is only about 6 inches in length and it is found from Canara down the Western Coast, along the base of the Nilgiris to Travancore Hills and Ceylon. The body is compressed and the upper jaw is the longer of the two. The lower labial fold is interrupted. In the mature males the snout is covered with large pores. There is only one pair of small barbels which are difficult to make out at times. There is a thin maxillary pair extending to below the centre of the orbit in some specimens while it is very minute in others. The dorsal fin commences midway between the snout and the base of the caudal fin. Its last undivided ray is articulated, smooth and feeble. Some of the branched rays in the mature males are elongated. The caudal is deeply lobed. The lateral line is complete with 2½ rows of scales between it and the base of the ventral fin. *Colour*.—The fish is silvery white, with a deep black oval mark on the lateral line covering the scales from about the fourteenth to the eighteenth. There is a dark band along the dorsal fin. The caudal fin is red, tipped with black.

It will be seen from the above description that this species shows marked sexual dimorphism. The form described as *Barbus mahecola*

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[1] *B. mahecola* and *B. filamentosus* are males and females of the same species. See Hora, *Rec. Ind. Mus.*, XXXIX, p 22 (1937) and Hora and Law, *Rec. Ind. Mus.*, XLIII, p. 245 (1941).

(Cuv. & Val.) is a female in which the tubercles are absent on the snout and the rays of the dorsal fin are not elongated beyond the membrane. Similar sexual dimorphism is found in *Barbus chagunio* described above.

8. **MALABAR CARP. Barbus (Tor) khudree** var. **malabaricus** Jerdon.

D. 12–13$\left(\frac{3\text{–}4}{9}\right)$; P. 17 ; V. 9 ; A. 8 (3/5) ; C. 19 ; L. 1. 24.

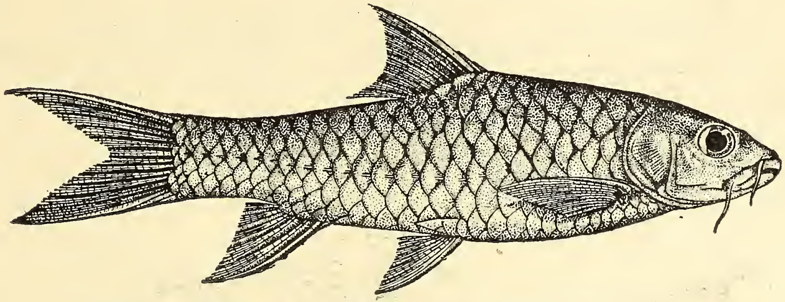

Fig. 8.—*Barbus* (*Tor*) *khudree*, var. *malabaricus* Jerdon.

This fish is an inhabitant of the streams of South Canara, down the Western Ghats to the Travancore Hills. It attains at least 18 inches in length. The dorsal and ventral profiles are moderately convex. The upper jaw is slightly longer than the lower one. The lips are thick and the lower labial fold is complete and the lower lip is provided with a median lobe. There are two pairs of barbels of which the maxillary pair reaches to the hind margin of the orbit while the rostral pair is shorter. The dorsal fin arises in advance of the ventral and its last undivided ray is osseous, but weak. The lateral line is complete with 1½ rows of scales between it and the base of the ventral fin. *Colour.*—The fish is bluish above, becoming white on the abdomen. The fins are usually blue and the eyes are red. Sometimes the fish is brown and the dorsal, pectoral and ventral fins are red, or against the edges of the finc may be dark.

This species is a race of the Deccan Mahseer or Khudree (*Barbus* (*Tor*) *khudree* Sykes) in which the dorsal fin has a weak and articulated spine.

Genus : Labeo.

9. **ROHU. Labeo rohita** (Ham).

Vernacular names:—*Ruhu*, Ooriah; *Ruee*, Ben.; *Nga-myit-chin* and *Nga-myit-tsan-nee*, Burmese; *Dum-bra*, Sind.

D. 15-6 $\left(\frac{3}{12\text{-}13}\right)$; P. 17; V. 9; A. 7 (2/5); C. 19;
L. 1·40-42.

This is the commonest carp of the plains. It is highly esteemed as food and is to be found in all sorts of water, the best being those taken in clear running water, and not too large. It is deep in form, the dorsal profile being more convex than the ventral. The greatest width of the head equals its length excluding the snout which is obtuse, depressed, but projecting beyond the jaws. No lateral lobe is present. Lips thick, fringed with a distinct inner fold above and below. Generally there is a short and thin maxillary pair of barbels, though a rostral pair is sometimes present. The dorsal fin arises about midway between the snout and base of caudal fin. Pectoral is as long as the head excluding snout. Ventrals are inserted below the third or fourth dorsal ray. Caudal is deeply forked. There are 6-6½ rows of scales between lateral line and base of ventral fin. The fish is bluish or brownish along the back, becoming silvery on the sides and beneath; sometimes there is a red mark on each scale. In some specimens the fins are black.

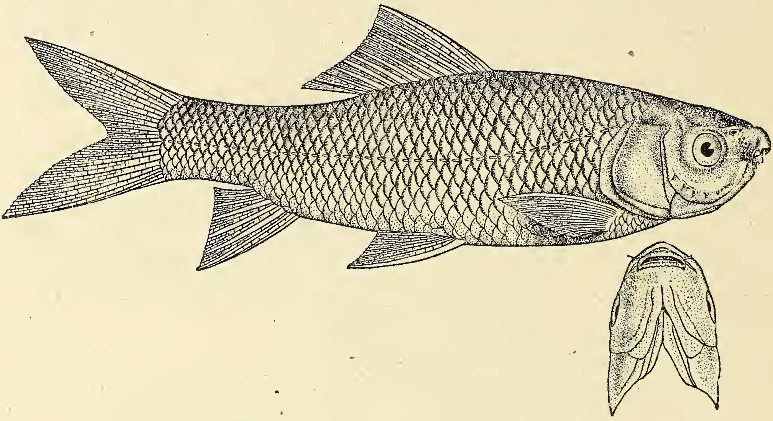
Fig. 9.—*Labeo rohita* (Hamilton).

Rohu frequent the sluggish water of pools in rivers, and will occasionally be seen in shoals in slow runs sucking in vegetation off the top of the water. I have caught them while doing this in the Saber Matti near Ahmedabad in the following way:—On observing closely I noticed that green weed was the dainty morsel these fish were foraging. Some was collected and a fine cast with a very small hook provided the tackle; attaching the weed to the hook was a most tedious business. When this was done by wrapping it round the hook and tying it into position with fine silk the weed would come off as soon as it was in the water or swell too much to tempt the fish. Perseverance conquered. When the correct amount was gauged, a light float (quill) was attached to the cast 10 inches from the hook, and the bait allowed to move down with the current till it was engineered into the midst of a shoal where it was immediately taken, the float signalling the pop, pop movement of the fish sucking it in which was the indication to strike. I caught several fish this way, with the shoal still feeding.

The Rohu has a very small mouth set very low in the head, and almost below it. They are game fish, however, and when hooked will jump right out of the water two or three times. They provide one of the chief foods in Bengal and Bihar and are quite tasty. They do well in tanks where they are fished for in the commonly known way (seen chapter on 'Tank Angling').

Hand Line Fishing for Rohu.—I was shown by an old Mohamedan how to catch Rohu on a hand line, 'Tuggy' or 'Tungoos'

It is slow work but great fun when a fish is hooked. They seem to put up a much better fight in a river than in a tank. I detail this method so that anyone keen enough may give it a trial. I have caught fish up to 20 pounds in this way.

River Fishing for Rohu.—A line 60 yards in length is wrapped criss-cross over a small dried vegetable marrow. This is the substitute for the winch.

The Mount.—The mount is a thick piece of string $\frac{1}{8}$ inch thick, with a heavy weight 6 ozs or more fixed on to one end, and to the other end the line is attached. Equal distance from the ends are two fine pieces of line attached to the mount about 6 inches long, with a large hook attached (size 4/0 in Limerick hooks) to each length. Mount is about a yard long.

These are baited with nice juicy red earthworms, as much as they can hold, and then enough line is collected off the bobbin, and held in loops or laid in coils on the sand. The cast is then made by swinging the weight round in the manner of a stone sling, and cast into a slow flowing part of the river, which is either connecting two pools or is known to be a feeding ground.

The next operation is to collect in the line till it is as near taut as you can get it, without moving the weight, and to fix the line into a slotted bamboo peg which will give a slight resistance to a tug; this with the weight hooks the fish, and the funs begins. The peg is about 6 inches high.

Playing the Fish.—The line is picked up as soon as a run is registered, and the fish is played through the fingers, exactly the same way as we do on a rod and reel.

Clubbing the Fish.—When the fish is tired, and the mount comes into the hand, raise the head gradually to the surface. A small club which is held by the chin against the chest is used for knocking the fish on the head. The fisherman goes over his knees into the water to do this.

It is in this way with a lump of Raggi paste, the size of a duck's egg and no added weight that the big Mahseer and Rohu of the Cauvery and Cubbany rivers in Mysore are taken; and it was in this way, a correspondent informs me, that Rivett Carnac's 119-pound fish was captured. Substituting of course the rod and reel for the marrow!

Rohu Rising.—A Rohu comes to the surface and breaks the water with a loud splash and strong swirl, after which he generally lets up two bubbles. Bottom fishing for Rohu is dealt with fully in the chapter 'Tank Angling.'

10. KALA BANSE. Labeo calbasu (Ham.)

Vernacular names:—*Nalla-gandu-menu*, Telugu; *Kalbasu* and *Kunda*, Ben.; *Cuggera* (Siane); *Mahlee*, Assam; *Kala beines*, Ooriah and Hind.; *Di*, Punj.; *Di-hee*, Sind; *Dai*, Cutch; *Kurri-menu*, Canarese; *Nga-nek-pya*, *Nga-noo-than* and *Nga-ong-tong*, Burmese.

$$\text{D. } 16\text{-}18\left(\frac{3}{13\text{-}15}\right);\ \text{P. } 19;\ \text{V. } 9,\ \text{A. } 7\left(\frac{2}{5}\right);\ \text{C. } 19;$$

$$\text{L. } 1{\cdot}40\text{-}44.$$

The width of head equals its length excluding snout. Mouth narrow, obtuse and depressed. No lateral lobe but pores are present.

Lips thick, fringed, more especially the lower one, each having a distinct inner fold. There are four barbels, the rostrals being slightly the longer, equalling the diameter of the eyes. Dorsal fin arises midway between the snout and the base of the caudal fin. Ventrals commence below the fourth or fifth dorsal ray. Caudal is deeply forked. There are 5½ to 6 rows of scales between the lateral line and the base of the ventral fin. The fish is blackish, sometimes with a scarlet centre for many of the scales. It grows to 3 feet in length.

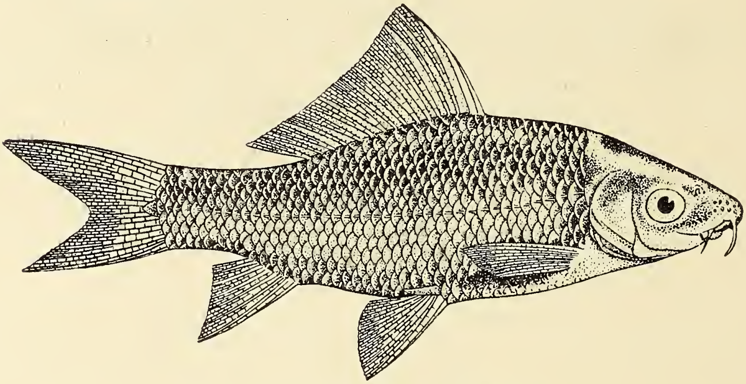

Fig. 10.—*Labeo calbasu* (Hamilton).

These fish seem to have a partiality for old masonry, walls and sunken trees in river and can be seen playing about in such places, sucking, and rubbing their sides against the masonry or trees, as the case may be. They are in structure the same as the Rohu, and are even known by some as the Black Rohu. This fish is well illustrated in Thomas' 'Rod in India'. I have taken them on small Fly Spoon, once or twice, but this is most unusual as the mouth of the fish is set right below the face and is very small. I was fishing for Mahseer at the time.

They rise unlike the Rohu in a most frightened manner, coming up to the surface with a rush, almost perpendicularly, and turning on the surface, go down as fast. They are game fish, and are best caught in the manner shown under 'Tank Angling'. They do well in tanks. The largest I have caught was 16 pounds.

Genus : **Cirrhina.**

11. **MIRGIL. Cirrhina mirgala** (Ham.)

Vernacular names:—*Mirrgah*, Ooriah; *Mirgala*, Beng. and Hind; *Naini*, Hind. (N.-W.P.); *Nga-kyin* and *Ngga-gyein*, Burmese; *Mor-ah-kee*, Sind and Cutch.

$$\text{D. } 15\text{-}16\left(\frac{3}{12\text{-}13}\right);\ \text{P. } 15;\ \text{V. } 9;\ \text{A. } 8;\ \left(\frac{3}{5}\right):\ \text{C. } 15;$$

$$\text{L. } 1{\cdot}40\text{-}45.$$

This is a fine fish of elegant appearance. The greatest width of the head equals its length behind the middle of the eyes. The eyes are situated in the anterior half of the head. Width of mouth equals 2/5 of the length of the head. Pores may or may not be present on rather nearer to the snout than to the base of the caudal fin, and the snout. Only two barbels are present. The dorsal finarises rather nearer to the snout than to the base of the caudal fin, and opposite the 12 scale lateral line. Pectoral fin is as long as the head excluding the snout, and does not reach the ventral. Caudal fin deeply forked 5½ to 6 rows between lateral line and the base of ventral fin. *Colour.*—Silvery dark grey along the back, sometimes having a coppery tinge. The pectoral ventral and anal orange stained with black. Eyes golden. The fish grows up to 3 feet in length. (See also Chapter X.)

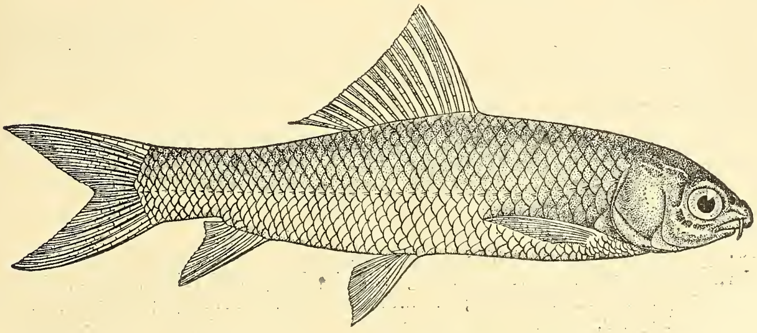

Fig. 11.—*Cirrhina mirgala* (Hamilton).

12. **CIRRHINA CIRRHOSA** (Bloch).

Vernacular names.—*Ven-candi*, Tam.; *Aruzu*, Telugu.

$$\text{D. } 17\text{-}19\left(\frac{3\text{-}4}{14\text{-}15}\right);\ \text{P. } 19,\ \text{A. } 8\left(\frac{3}{5}\right);\ \text{C. } 19,\ \text{L. l. } 42\text{-}44.$$

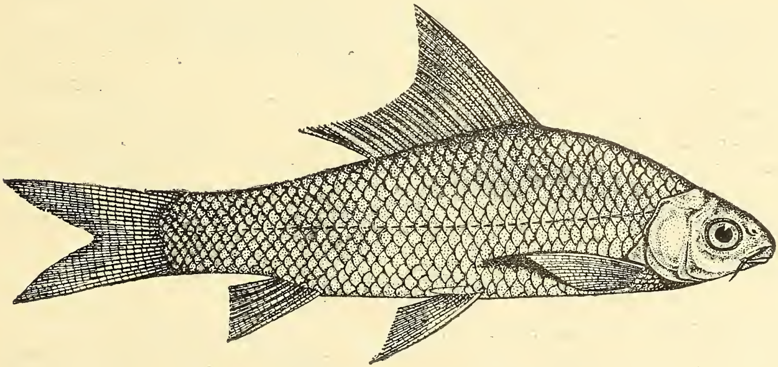

Fig. 12.—*Cirrhina cirrhosa* (Bloch).

The dorsal profile of this fish is more convex than the ventral one. The greatest width of head equals its length excluding snout. Width of mouth equals 1/3 of the length of head. Usually some fine pores are present on the snout. Four barbels are present of which the rostrals are rather longer. The dorsal fin arises considerably in advance of the ventrals and midway between the snout and the posterior position of the base of the anal gn. In some large specimens the first few rays are very much elonged. Caudal deeply forked. There are 5½ to 6 rows of scales present between the lateral line and the base of the ventral find. *Colour.*—Silvery, every scale having a red centre except along the abdomen where they are of dull yellowish white. Dorsal, caudal the outer end of the anal and pectoral stained with grey.

Mirgal or Naini are caught in the same manner as the Rohu, in river though they do not come up to the surface like the Rohu to suck in vegetation. The mouth of this fish is set higher in the head, though small and of the same warty construction as the Kala Banse. They do excellently in tanks and are quite game fish, caught in the same manner as the Rohu in tanks.

Genus : **Catla.**

13. **CATLA. Catla catla** (Ham.)

Vernacular names :—*Botchee*, Telugu ; *Catla*, Beng. and Hind., Punj. ; *Barkur*, Ooriah ; *Nga-thainv*, Burmese ; *Tambara*, Hind. (*Bombay*) ; *Boassa*, Hind. (N.-W.P.) ; *Tay-lee*, Sind.

$$\text{D. } 17\text{-}19\left(\frac{3\text{-}4}{14\text{-}16}\right);\ \text{P. } 21;\ \text{V. } 9,\ \text{A. } 8\left(\frac{3}{5}\right);\ \text{C. } 19;\ \text{L. l. } 40\text{-}43.$$

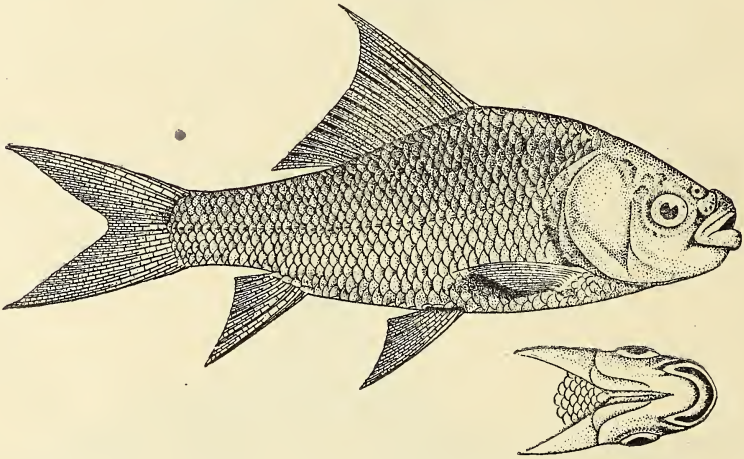

Fig. 13.—*Catla catla* (Hamilton).

This fish is largely employed for stocking tanks. It grows to about 6 feet in length. It is much esteemed as food when not exceeding two feet for the fish becomes coarser as it grows bigger.

The eyes with free orbital margins are situated in the anterior half of the head which is broad and the greatest width of which equals its length behind the middle of the eyes. The mouth is wide with a prominent lower jaw. In large specimens pores may be present on the snout. No upper lip, but the lower one is large and folded. No barbels present. Body is moderately compressed. Dorsal profile more convex than the abdominal one. The dorsal fin arises in advance of the ventrals. Pectoral extends to the ventrals which in males reach the anal. Anal laid flat, reaches to beyond the commencement of the caudal. There are 5½ to 6½ rows of scales between the lateral line and the base of the ventral fin. The fish is greyish above becoming silvery on the sides and beneath. Fins are dark coloured, becoming nearly black in some specimens.

The diet of this fish is difficult to determine with any certainty, but it is occasionally taken in tanks when fishing for Rohu, and is essentially a sporting fish of the tanks alone. (See chapter under 'Tank Angling'.)

Catla rise much in the same fashion as Rohu, and have the same habit of sucking on the surface, where scum or green slime has collected. An expert with dry fly may capture them on a hook baited with the green weed mentioned under Rohu. They are game and good fighters.

Genus : **Barilius.**

14. INDIAN TROUT. Barilius (Opsarius) bola (Ham.)

Vernacular names :—Hind. *Bola Goha*, and *Buggarah*. Beng. *Bola*; Punj. *Pahtah*; Behar *Chagunee*; Ooriah *Bugguah*; *Korang*, Assam.

D. 3/7-8; A. 3/10; P. 13; V. 9; C. 19; L. 1. 88-94.

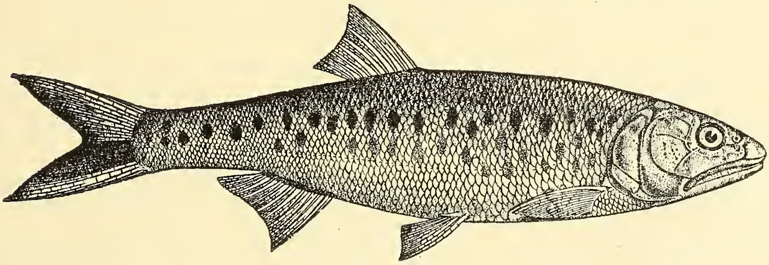

Fig. 14.—*Barilius* (*Opsarius*) *bola* Hamilton

This fish possesses the characteristic Trout-like form with the head and body greatly compressed, the head being sharply pointed. It is proportionately smaller in the younger individual. Its dorsal profile is scarcely arched while the ventral one is somewhat convex. The eye is situated entirely in the anterior half of the head and in adult specimens the mouth opening extends about 1½ diameter of the eye behind the posterior margin of the orbit. The mouth is very wide and directed obliquely upwards. The upper jaw is the longer and is deeply notched in the middle to receive a prominent knob of the lower jaw. Barbels are absent and the scales are very small. The lateral line is carried anteriorly and then it is continued to the lower half of the caudal fin. The dorsal fin arises midway between the posterior margin of the orbit and the base of the caudal fin; it is behind the anterior origin of the ventrals. The pectoral fin is as long as the head behind the eye, and is separated from the ventrals by a considerable distance. There is a scaly appendage in the axil of the pectoral fin. The colouration is much lighter in young individuals than in the adult. The back is greenish grey.

The Indian Trout, or *Barilius bola*, as is better known, is really not a trout. He is game looking and quite good eating. He is common over all N. India and Burma, and large bags can be made with fly spoon or fly. I have had 40 fish in a couple of hours in the

Sahmaw Chaung and many over 2 pounds in weight. This fish is excellently illustrated in colour in the B.N.H. Society's Journal No. 2, Vol. XXXIX.

The maximum weight given in the 'Rod in India' is well exceeded by the fish in Burma, and I should call it 3 to 4 pounds. My best was 3 pounds and was in a very small stream (see notes on 'Sahmaw Chaung'). In large rivers he would grow proportionately in weight and dimensions.

Good Bait for Mahseer.—The small one are particularly beloved of the Mahseer, so make an excellent live or dead bait. They will occasionally jump out of the water when hooked, and seem to prefer slow moving water above a rapid with fairly large boulders, to the actual rapid itself. I have been most successful in smooth water. They are highly predacious fish, as the following amusing incident will prove.

While I was at Sahmaw in Burma, I had the forest officer staying with me. He was a keen fisherman. The stream was about 15 yards in front of my bungalow, and had a nice pool in front and in full view of the verandah. After tiffin 'George' as he was commonly called, made a cast and was taken by what appeared to be a good fish. The reel screamed, the rod bent in two and a furious fight went on for about 10 minutes. This was being watched by an interested company from my verandah, when suddenly the rod slacked and we thought he had lost his fish. He reeled in a small *B. bola* about 6 inches long which had obviously been taken by a large fish, and the fight was the disputed right of who should have the fish, George or the big fellow ! ! He suffered much leg pulling for taking 10 minutes to land a fish of a few ounces.

Tackle and fishing for this fish is the same as for small Mahseer, as mentioned in Chapter IV.

15. **BARILIUS TILEO** (Ham.)

Vernacular names :—*Tilei*, *Sel-len*, *Boolla* and *Sund-u-a-rie*, Assam.

D. 9 (2/7); P. 14; V. 9; A. 13 (3/10); C. 20; L. 1. 69-75.

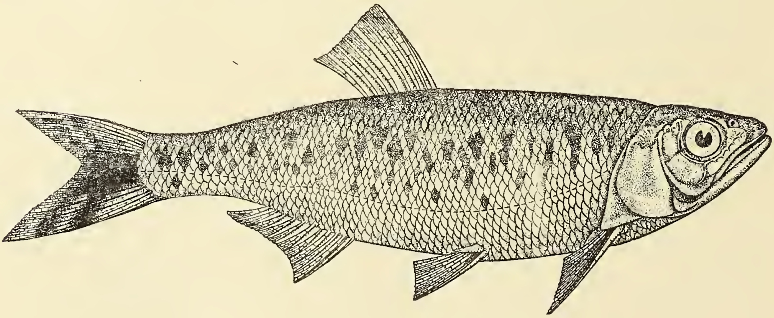

Fig. 15.—*Barilius tileo* Hamilton.

This is the only other fish likely to be confused with *B. bola.* It is similar in colour, but does not attain more than one and a half pounds in weight. It is distinguishable by its shape, being 'pot bellied' *i.e.* the abdominal profile more convex than the dorsal. The snout is pointed, and back almost straight giving the appearance of the head being cocked up. It is taken in similar water to that of *Barilius bola* and in the same way. Fights well. *General.*—It is a good table fish but bony.

Genus : **Chela.**

16. **CHILWA. Cheela argentea** Day.

Vernacular names :—*Chaya-vellachee* or *Vellachee-cundee*, Tam.

D. $9\text{-}10\left(\frac{2\text{-}3}{7\text{-}8}\right)$; P. 15; V. 8; A. $17\text{-}19\left(\frac{3}{14\text{-}16}\right)$; C. 19; L. l. 43-45

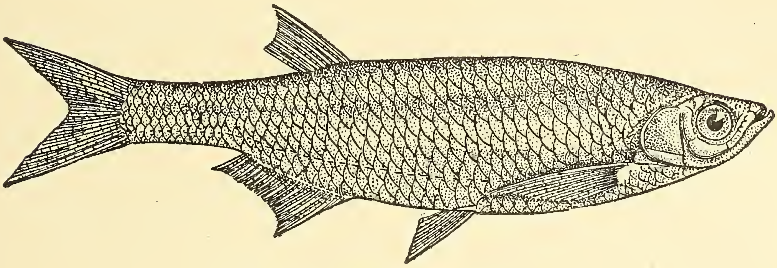

Fig. 16.—*Cheela argentea* Day.

This is a bright silvery fish, keeping mostly at the surface of the water. It has a long, more or less compressed body with a small head and upturned mouth. The cleft of mouth extends to below the anterior third of the orbit. There is a knob above the symphysis of the lower jaw. The sub-orbital ring of bones is very broad and nearly covers the cheek, the third almost touching the preopercular ridge. The breast is without a sharp edge. The dorsal fin is situated over the commencement of the anal fin, and is in the posterior, third of the distance between the snout and the base of the caudal fin. The pectoral fin reaches the ventral and the caudal is deeply forked. The lateral line descends gently for the first twelve scales, and finally attains the centre of the caudal. There are 1½ rows of scales between the lateral line and the base of the ventral fin, and about 27 to 30 rows anterior to the dorsal fin. *Colour.*—Silvery with a lateral band which fades after death. Caudal is dark edged, as is also occasionally the anal.

A small, narrow, closely-scaled, very delicate fish. It is difficult to handle without the hands getting covered with scales. Some anglers (the lover of the fly) will spend hours with a tiny fly, amusing themselves catching these fish. I find it tame sport, for even with three fly on at a time they give little fun. They are so long and narrow that they seem unable to hold the water against resistance of even the lightest rod. They make excellent bait for any fishing where predatory fish are sought as they seem to be the most favoured of all the small fish. If the Chilwa are moving in the river it may be safely assumed that the larger fish are on the feed, and good sport imminent. Does equally well in tanks and rivers.

(*To be continued.*)

THE BUTTERFLIES OF THE NILGIRIS.

BY

M. A. WYNTER-BLYTH, M.A. (Cantab.).

This list covers an area which extends from Mettupalaiyam in the South-East, from the Gudalur plateau in the North, and down to the Malabar boundary in the North-West. Otherwise it corresponds to the Nilgiri range and its slopes.

In compiling this list I have had little help from local collectors, but I am deeply indebted to Hampson's list of 1888. As most of his collecting was done in the Northern and North-Western Nilgiris and mine on the plateaux and the southern slopes, this has been of great value to me.

As a result of the great local variations in climate, rainfall and vegetation, it is impossible to give definite seasons for the appearance of particular butterflies to cover the whole area. Neither is it possible to allocate species to definite altitudes for the whole region, for these will naturally be found where their foodstuff grows and this is regulated by the climate. For instance, butterflies peculiar to the evergreen regions descend some 2,000 feet lower on the western slopes than on the southern because the evergreen forest does the same.

In the Southern Nilgiris and on the lower plateau February and March, and September and October, are the best seasons for butterflies. Butterfly life is always abundant at the foot of the south-eastern slopes, but April and May are comparatively poor months there. September to November is a good season for the northern and western slopes, but June to September and from December to February are poor. There is always good butterfly collecting to be had somewhere in the Nilgiris.

The following are the best localities for the collector. First of all comes Kallar. This must be one of the very best collecting areas in India. Butterflies are always abundant there and it seems to specialise in rarities. So far, I have caught 192 different species in the narrow strip about half a mile long around the ford and along the river at Kallar. I can especially recommend the ford over the Coonoor River where I have caught a large proportion of my best Nilgiri butterflies.

The Nadgani Ghat, from the top to just below the Nilgiri-Malabar boundary, ranks an easy second to Kallar. At its best it is probably better than Kallar, but the season there is short while Kallar is good throughout the year. There are probably plenty of spots on the western slopes as good as the Nadgani Ghat, but they are all difficult of access and I do not know them. The foot of the Nadgani Ghat is probably excellent, but it is outside the scope of this article and rather too remote in these days of petrol rationing.

It is worth noting that the butterflies of the Southern and Western Nilgiris are very different.

For evergreen forms on the southern side of the hills, Wenlock Bridge and the Runneymede area below Coonoor are good. For the forms peculiar to the plateaux anywhere on the edge of a shola will produce the few species to which this applies, Gudalur, the Droog and the Burliyar neighbourhood are all worth a visit.

Note.—The identification letters and figures are from Evans' 'Identification of Indian Butterflies.'

In the text the 'lower plateau' refers to the Coonoor-Ketti plateau and the 'upper plateau' to the 'Downs'.

PAPILIONIDÆ.

1. (A1.1β) **Troides helena minos**, Cr.

From 1,350′ to 8,000′; not rare. On the Mettupalaiyam Ghat it appears from September to March and on the plateaux from February to May and from July to September. It is most easily caught early and late, feeding on lantana. It is common on the western slopes.

2. (A2·8β) **Tros jophon pandiyana**, M.

Quite common on the western slopes from 1,000′ to 3,000′. Not found elsewhere in the district.

3. (A2·9) **Tros hector**, L.

4. (A2·10β) **Tros aristolochiæ aristolochiæ**, F.

Both are abundant all the year round below the plateaux. Not rare on the lower plateau in the drier months.

5. (A3·5β) **Chilasa clytia clytia**, L.

Rather a scarce butterfly which is found up to about 4,000′. I have recorded it at Kallar in February, March and April and on the Nadgani Ghat in October.

6. v. *dissimilis*, L.

Distinctly rare. I have one specimen from Kallar in April.

7. (A4·1β) **Papilio polymnestor polymnestor**, Cr.

Common throughout the evergreen regions. Fairly common at Kallar and not rare on the lower plateau in the drier months.

8. (A4·10α) **Papilio paris tamilana**, M.

Quite common on the western slopes but rare in the Southern Nilgiris. I have a specimen from Ketti taken on 27/9 and it may be caught sparingly on the upper Mettupalaiyam Ghat at the end of the S. W. rains. I have seen it at Avalanche in February.

9. (A4·13) **Papilio crino**, F.

Sometimes very common at Kallar where it appears throughout the year. It is also found, though less commonly, in the evergreen region and also on the lower plateau in February and March. I have not yet seen it on the western slopes.

10. ♂ v. *montanus*, Fd.

Appears with the typical male, but is rare.

11. (A4·14) **Papilio buddha**, Wd.

Western slopes only; not uncommon according to Hampson. I myself have not caught it though I have seen it in a local collection.

12. (A4·16) **Papilio dravidarum**, WM.

Hampson says that it is common on the western slopes and rare on the northern, but I have not yet seen it.

13. (A4·19β) **Papilio helenus daksha**, M.

Very abundant in the evergreen region and fairly common both above and below it.

14. (A4·25) **Papilio polytes romulus**, Cr.

The male is abundant everywhere. The typical female is scarce.

15. ♀ v. *stichius*, Hub.

This is the commonest female form, though it is never abundant.

16. ♀ v. *cyrus*, F.

Appears, but is very rare.

17. (A4·26α) **Papilio demolion liomedon**, M.

Rare. Found only on the western slopes.

18. (A4·27α) **Papilio demoleus demoleus**, L.

Abundant everywhere.

19. v. *orange*.

The form in which the yellow markings are replaced by orange is not rare at Kallar.

20. (A5·4α) **Pathysa nomius nomius**, Esp.

At times extremely abundant at Kallar. Best caught settling on the damp mud of the ford.

On 19-2-'42 I caught a most remarkable aberration of this species. Of two of the bars on the upper forewing there is no trace and there are other minor differences on both the upper and under sides. This specimen was caught after a period of normal weather and I have seen no other similar specimens since. Hampson states that *nomius* is very rare, having caught but one specimen. As far as I know it is almost confined to the Kallar district in the Nilgiris. In Hampson's day Kallar must have been inaccessible, neither the railway nor the ghat road having been constructed.

Note.

(A5·β) **Pathysa antiphates naira**, M.

In Coorg this species is commoner than *nomius*. Consequently it seems reasonable to suppose that it may occur at low elevations on the western slopes of the Nilgiris.

21. (A6·2α) **Zetides sarpedon teredon**, Fd.

22. (A6·3β) **Zetides doson eleius**, Fr.

23. (A6·8α) **Zetides agamemnon menides**, Fruh.

Sarpedon is common from the plains to the tops of the highest hills, though only found on the plateau in the dry months.

Agamemnon is common throughout the year to about 4,500′.

Doson is less common and only found at low elevations. All can easily be caught settling on damp mud and flowers, especially lantana.

PIERIDÆ.

24. (B1·α) **Leptosia nina nina**, F.

Always abundant at low elevations. Flies low in jungle and extends up to 6,800′.

25. (B4·10) **Pieris canidia canis**, Evans.

Common all the year round on the plateaux. *Canidia* is found on the Himalayas and on the hills of Southern India. Our race is typical of the law that Southern Indian races are smaller and darker than those from Northern India.

26. (B6·3) **Delias eucharis**, Drury.

Common throughout the year on the plains. The foodstuff of the larva is loranthus, consequently the female is frequently seen flying high among those trees upon which this parasite grows. It is found in small numbers on the Mettupalaiyam Ghat during most months of the year and on the lower plateau in February, May, August and September. Common on the western slopes.

27. (B8·β) **Belenois mesentina mesentina**, Cr.

Fairly common everywhere from July to December, and in March.

28. (B9·2α) **Huphina nerissa evagete**, Cr.

Abundant all the year round on the Mettupalaiyam Ghat; not rare on the plateaux in the dry months. I have not seen it on the Nadgani Ghat though it may occur at low elevations.

29. (B9·3β) **Huphina nadina remba**, M.

Common on the western slopes. Hampson states that it is a rare straggler over the rest of the district.

30. (B10·3β) **Appias indra shiva**, Swin.

Rare; I have only two specimens, one from Wenlock Bridge in March and one from Ketti in May.

31. (B10·4α) **Appias libythea libythea**, F.

Hampson states that it is rare. I have not seen it.

32. (B10·5β) **Appias lyncida latifasciata**, K.

'1,000′ to 3,000′,' Hampson. I have three specimens, all caught at the ford at Kallar, 9/7, 2/9 and 16/2. Reputed not to be rare on the Kotagiri Ghat.

33. (B10·6β) **Appias albina darada**, Fd.

Most abundant everywhere. ('Rare,' Evans).

34. ♀ v. *semiflava*, Fr.

Found together with the typical female but much less common.

35. (B11·1) **Catopsilia crocale**, Cr.
36. (B11·2) **Catopsilia pomona**, F.
37. ♀ v. *catilla*, Cr.
38. (B11·4) **Catopsilia pyranthe minna**, Herbst.
39. (B11·5) **Catopsilia florella gnoma**, F.

All except *catilla* are common everywhere except on the plateaux during the S.W. rains.

Pyranthe and *florella* are difficult to distinguish apart. In *pyranthe* the marginal band of the upper F.W. is continuous and narrowed posteriorly; in *florella* this band is macular and as broad at interspace 2 as at the apex. This difference is usually obvious in the females.

40. (B15·1) **Terias libythea**, F.

Abundant everywhere.

41. (B15·2α) **Terias laeta laeta**, Bdv.

It took me a long time to come across this usually abundant insect. Eventually I found it in large numbers below Coonoor and at Gudalur in October.

42. (B15.4α) **Terias blanda silhetana**, Wall.

The most abundant Terias at low elevations. It does not extend far into the hills.

43. (B15·5α) **Terias hecabe simulata,** M.

Abundant at all seasons everywhere. A very hardy insect which I have caught at 11,500′ in the Himalayas. I have an albino specimen from Kallar.

44. (B15·7α) **Terias andersoni ormistoni,** Watkins.

Rare. I have two specimens from Kallar, dated 20-6-'41 and 16-2-'43.

45. (B16·9α) **Colias hyale nilgiriensis,** Fd.

Very common above 7,000′ but not caught below the plateaux. Appears throughout the year. Like *P. canidia canis, C. hyale nilgiriensis* is peculiar to the hills of Southern India with another race in the Himalayas. It is smaller and darker than the Himalayan form and only has the white female.

46. (B17·1) **Ixias marianne,** Cr.

Always very common at the foot of the hills and I have caught it twice at Ketti, 6,500′, though I have never seen it at intermediate altitudes. The female is very much less common than the male.

47. ♀ v. *white.*

48. ♀ v. *orange.*

Neither of these female forms is mentioned in Evans' "Identification of Indian Butterflies'.

In the white form the orange tip is absent and its place is taken by heavy black markings and confluent white spots. This is not rare at Kallar in August and July.

In the orange form pale orange takes the place of the white background. I have seen one specimen taken at Kallar in October.

49. (B17.2β) **Ixias pyrene frequens,** Butler.

Very common at the foot of the Mettupalaiyam Ghat and on the northern side of the hills. Unlike the northern race, satadra, frequens does not extend into the hills.

50. (B18·1α) **Colotis amata modesta,** But.

51. (B18·4α) **Colotis fausta fulvia,** Wall.

52. (B18·5β) **Colotis etrida etrida,** Bdv.

53. (B18·6) **Colotis eucharis,** F.

54. (B18·7α) **Colotis danae danae,** F.

All are common in scrub country on the plains. Although Hampson mentions *eucharis* from the Nilgiris, I have not seen it, except for a single specimen in a local collection. No locality was given.

Etrida appears occasionally at Kallar and as a straggler up to 6,500′. I have recorded it in February and April.

I have caught *fausta* once at Kallar in April. Hampson says that it appears as a straggler on the plateaux.

I have recorded *amata modesta* on two occasions at Kallar; 19-2-42 and 9-7-43. On both dates it was fairly common.

I have taken *danae* once at Kallar, 7-5-42, but have no other record.

55. (B19·β) **Hebomoia glaucippe australis,** But.

Not rare on the plateaux in the dry months; always common at low elevations.

56. (B20·2α) **Parenonia ceylanica ceylanica,** Fd.

Common throughout the year to about 3,500′ in the Southern Nilgiris. The female is considerably less common than the male. I have not yet noticed this species on the Nadgani Ghat. Hampson gives its distribution as from 1,000′ to 3,000′.

57. (B20·3) **Parenonia valeria hippia**, F.

I have not found this butterfly on the southern side of the hills. Hampson states that it appears from 1,000′ to 3,000′. It is probably an inhabitant of the foot of the northern slopes. Common round Bangalore.

Note.

(B7·2) **Prioneris sita**, Fd.

This butterfly is common in Coorg and should appear on the western slopes of the Nilgiris.

(B10·7β) **Appias paulina wardi**, M.

Hampson mentions this species but it is obvious that he refers to *albina*, which is omitted from his list. This is a rare butterfly but it should turn up somewhere in the district.

DANAIDÆ.

58. (C1·1β) **Hestia lynceus malabarica**, M.

Common on the western slopes to which Hampson says that it is confined. I have seen two specimens in a local collection which are said to have been caught on the Mettupalaiyam Ghat, but I doubt the accuracy of this statement.

59. (C2·1α) **Danais aglea aglea**, Cr.

Common throughout the year. Not found above 5,000′.

60. (C2·7) **Danais nilgiriensis**, M.

Peculiar to the hills of Southern India. It is only found above 4,500′ and is common throughout the year.

61. (C2·9) **Danais limniace mutina**, Fruh.

Strangely enough this butterfly does not seem to be very common in the Nilgiris.

62. (C2·10β) **Danais melissa dravidarum**, Fruh.

Always most abundant on the slopes and at the foot of the hills. Often common on the plateaux.

63. (C2·12) **Danais plexippus**, L.

64. (C2·15) **Danais chrysippus**, L.

65. ♀ v. *alcippoides*, M.

66. ♀ v. *dorippus*, Cr.

Plexippus and *chysippus* are fairly common everywhere, especially at low elevations.

I assume that the two varieties of *chrysippus* appear as Hampson states that he had seen the varieties of *H. misippus* that mimic them.

67. (C3·7β) **Euplœa core core**, Cr.

68. (C3·12β) **Euplœa coreta coreta**, Godman.

Both are common on the plateaux during the dry months; common elsewhere throughout the year.

69. (C3·18β) **Euplœa crassa kollari**, Fd.

Rare. I have caught two males of this species in May and October at Kallar. I have not had the female. This species has not previously been recorded from the Nilgiris as far as I know.

SATYRIDÆ.

70. (D2·3♂) **Mycalesis anaxias anaxias**, Hew.

Confined to evergreen forest. Common on the Mettupalaiyam Ghat where it is the prevalent Mycalesis throughout the year. It is also common on the western slopes.

71. (D2·9♂) **Mycalesis perseus typhlus**, Fruh.

72. (D2·10♂) **Mycalesis mineus polydecta**, Cr.

73. (D2·11) **Mycalesis igilia**, Fruh.

74. (D2·12♂) **Mycalesis visala visala**, M.

75. (D2·14) **Mycalesis subdita**, M.

76. (D2·16♂) **Mycalesis khasia orcha**, Evans.

These are confusing species to identify. The under forewing brands of the males are the most useful characteristics : it is often impossible to separate some of the females.

Perseus : both the brands are small and black and the under hindwing ocellus in 3 is out of line. Expanse : 43 to 52 mm's.

Hampson states that the Nilgiri W.S.F. has the ocellus on the forewing as large as that in *mineus*. This does not apply to those that I have caught on the Mettupalaiyam Ghat ; in these the ocellus is absent, or, very occasionally, faint. The D.S.F. is very common at Kallar from January to April. The W.S.F. is not nearly as common and appears there in July and August. It is found up to about 4,500′ and is also common on the western slopes.

Mineus : the under forewing brand is small and brown. Expanse : 45 to 54 mm This butterfly is not common on the Mettupalaiyam Ghat and the only specimen in my collection is a female caught in December. It is common in Coorg and Hampson mentions it in his list . . . but this is of doubtful value as he does not mention any of the four following species. I feel, however, that it must be common enough somewhere in the Nilgiris.

Igilia : a long-branded species. The under forewing brand extends outside the discal band which is bent slightly outwards immediately above the brand. Otherwise the band is straight and sometimes distinctly broad. Usually there is no ocellus in 1 on the under forewing and the underneath is light in colour in the W.S.F. The termen is rounded and the apex pointed. Expanse : 44 to 45 mm. Common in the Gudalur forests in October.

Visala : a long-branded species which is easily recognised by the pointed apex and straight termen of the D.S.F. and the large ocellus of the W.S.F. Rare. One specimen from the Kallar jungles in May. Expanse : 45 to 55 mm.

Subdita : the under forewing brand is up to, but not beyond, the discal band. There is always an ocellus on the under forewing in 1 and the underside is very black in the W.S.F. The discal band is straight. Expanse : 47 to 56 mm's.

Quite common on the Mettupalaiyam Ghat at low elevations and can be caught during most months.

Khasia : the under forewing brand is similar to that of *subdita* but there is generally no ocellus in 1 and the underside is pale in the W.S.F. The discal band is curved slightly inwards round the large ocellus of the under forewing and the apex of the forewing is more pointed than in *subdita*. Expanse : 46 to 48 mm.

Unless a good series is obtained this species is difficult to separate from *subdita* in the D.S.F. In this, and in the four previously mentioned *Mycalesis*, all characteristics, except the brands, are liable to variation.

The females of *mineus*, *igilia*, *subdita* and *khasia* are very difficult to distinguish apart. *Subdita* always has an ocellus in 1 on the under forewing. *Igilia* and *khasia* are generally considerably smaller than the other two.

77. (D2·20) **Mycalesis adolphei**, Guer.

Confined to the hills of Southern India. This species is exclusively a high elevation butterfly and will not usually be found below 6,000′. In this part of the Nilgiris it seems to be confined to the edges of the jungles at the top of the Mettupalaiyam Ghat.

Hampson states that it has two broods ; in May and in August. This statement must refer to another part of the Nilgiris as I have caught it near the

Droog in December and near Coonoor in October. It must be remembered that the climate of the Nilgiris varies considerably from place to place. Therefore it is impossible to make definite rules about the times of emergence of species to cover the whole district.

78. (D2·32β) **Mycalesis patnia junonia**, But.

Common up to about 6,500′. It is found all the year round in thick forest in the S. and W. Nilgiris but is apparently not found elsewhere in these hills. *Junonia* is very different from the Ceylon form, *patnia*. The pupil of the large ocellus on the forewing has only a supercilium of sullied white while that of *patnia* is completely encircled with tawny yellow. Our subspecies is of a darker brown and has no yellow streak in the cell. These differences are quite constant; are they not sufficient to give our race specific rank?

This is the commonest species of *Mycalesis* at Kallar and like others of the genus it seldom flies far out of thick jungle.

79. (D3·21α) **Lethe europa ragalva**, Fruh.

'3,000′ to 5,000′; rather rare,' Hampson. 'Rare in Coorg,' Yates. Not at all rare among the bamboo at Kallar. It is extremely difficult to catch in good condition, as it settles among the stems and seldom allows a proper stroke of the net. Unlike *drypetis* it is never found away from bamboo.

80. (D3·22α) **Lethe rohria nilgiriensis**, Guer.

In the Southern Nilgiris it is found above 4,500′ on the western slopes above about 2,500′. I have caught it from February to October. Fairly common.

81. (D3·23β) **Lethe drypetis todara**, M.

The male is common in bamboo jungle at Kallar between July and October but the female is very rare there. Both sexes are extremely common at Gudalur and on the Nadgani Ghat in October.

I have also caught it at Ketti, 6,500′, in August and December. As no bamboo grows near Ketti the larvae most probably feed on grasses at this altitude.

82. (D14·16) **Ypthima asterope mahratta**, M.

'Rare; northern slopes,' Hampson.

Rare in the Southern Nilgris. I have had the W.S.F. from Kallar on 31-7-'41 and 2-9-'42, and also from the Nadgani Ghat in October. The D.S.F. does not seem to appear in the Southern Nilgiris.

83. (D14·9) **Ypthima chenui**, Guer.

Peculiar to the hills of Southern India. Confined to open country on the plateaux where it is common from February to April.

84. (D14·10) **Ypthima ceylonica**, Hew.

Only appears on the southern slopes of the Nilgiris where it is very common.

85. (D14·11β) **Ypthima hubneri hubneri**, Kirby.

Very common up to about 5,600′. Found in the W.S., D.S., and a variety of intermediate forms.

86. (D14·13β) **Ypthima avanta striata**, Fd.

'Southern slopes, 2,000′ to 4,000′. W.S.F. in August,' Hampson.

'Rare; Nilgiris,' Evans.

I have not yet caught this species.

87. (D14·14α) **Ypthima philomela tabella**, Mar. and de N.

Common on the N.W. corner of the Nilgiris and on the Wynaad boundary. I have one possible D.S.F. specimen from Ben Hope (Mettupalaiyam Ghat) taken in March. This specimen is very indistinctly marked and is difficult of identification.

88. (D14·15α) **Ypthima baldus madrasa**, Evans.

Very common in a variety of forms.

89. (D15·1) **Zipoetis satis**, Hew.

Rare on the southern, but not rare on the western, slopes. Capt. P. Morrison Godfrey caught a specimen at mile 10/7 on the Mettupalaiyam Ghat Road 9-11-'41. I have caught a number on the Nadgani Ghat between 1,500′ and 3,000′ in October.

90. (D16·α) **Orsotrioena medus mandata**, F.

Common at all seasons in forest at low elevations.

91. (D22·1) **Melanitis leda ismene**, Cr.

92. (D22·2β) **Melanitis phedima varaha**, M.

93. (D22·3α) **Melanitis zitenius gokala**, M.

Apart from that of *leda* I have not found Evans' descriptions very helpful.

Leda ismene. As far as I know this is the only *Melanitis* to be found on the plateaux where it is fairly common. It is also quite common at Kallar and below Coonoor.

The W.S.F. is easily identified, the underside being grey, finely straited with brown and the ocelli well-defined and large. These characteristics immediately distinguish it from the other two species of *Melanitis.* The D.S.F. may easily be confused with *zitenius gokala.* Except that *gokala* is usually larger than *ismene*, it is difficult to distinguish between these two in the D.S.F.

Ismene is not exclusively a jungle butterfly, as the other two are. It will be found wherever there is shade. Expanse: 72 mm. (circa).

Phedima varaha. Not common and very difficult to catch, as, on the southern slopes, it lives in dense bamboo jungle.

So far I have only four specimens from which to draw my conclusions. (a) male, D.S.F., Kallar, 28/4; (b) male, W.S.F., Kallar, 15/7; (c) female, W.S.F. Kallar, 14/8; (d) male, W.S.F., Nadgani Ghat, 23/10. These were all caught at altitudes between 1,250′ and 2,000′.

The males are almost unmarked on the upperside, except for a somewhat blurred black spot in 3 and 4. The white spot is vestigial. Above both dry and wet forms of the males are very much alike, though the shape varies as it usually does in this genus. The ochreous costal area is faintly discernible. Specimen d. is much more caudate at v.3 than the other two are.

In the D.S.F. specimen the underside is plain and of a light brown colour. The underside of the W.S.F. males is brown to dark brown striated with light purple (very heavily in the Nadgani specimen). They also possess minute but well-defined ocelli. Evans states that the underside of the W.S.F. of this species is ferruginous with prominent discal lines. This applies to my female specimen but not to the males.

The female specimen is remarkable. As it was caught in August, the middle of the first wet season at Kallar, when other wet season forms were flying, it is presumably a W.S.F. Nevertheless the underside is not ocellated, there being merely the vestiges of white spots on a light ochreous background. The discal lines are well-defined.

Above, there is a well-defined black mark at the end of the cell and beyond. The costa is ferruginous-ashy broadening to a bright ferruginous patch beyond the black mark. This shades into an ill-defined ashy brown area that reaches the termen. There are no traces of black and white spots in 3 and 4 and the forewing.

Expanse: (*a*) Male, 80 mm. (*b*) male, 78 mm. (*c*) female, 82 mm. (*d*) male, 78 mm.

Zitenius gokalai. The dry and wet season forms are very similar. On the underside the discal lines are more prominent in the W.S.F. and the markings are richer. On the upperside the markings are bright and well-defined in the W.S.F., but slightly less so in the D.S.F. Both forms are very similar to ***leda***, D.S.F., but *zitenius* is the larger.

This species is very common at the top of the Mettupalaiyam Ghat in March and December and at Kallar in December and early January.

Expanse: 72 mm. to 82 mm.

94. (D.) **Melanitis tristis**, Felder.

I have one ♂ corresponding to de Niceville's description of *M. tristis* which I caught at Kallar on 31-7-'41 in deep bamboo jungle. According to him this is a variety of *M. aswa* (*phedima?*) and had been recorded from N. India and the Wynaad. To me it seems to bear no resemblance to this species which I have caught at the same season. I therefore tentatively give it as a distinct species. I append a description below.

Sex: male.

Expanse: 66 mm.

Upperside: deep glossy-brown with a bluish tinge.

F.W. termen straight with an ashy border, narrow at the tornus, widened towards the apex and about 4 mm's. wide at the middle. Costa well curved.

H.W. termen with a narrow ashy border, violent tinged at the tornus. A small ocellus at 2 (the only markings on the upperside).

Underside: background brown, richly straited with violet.

F.W. discal band straight, beginning about 12 mm's. down the costa from the apex and pointing to the tornus. The apical area, outside the discal band, is of a lighter violet, containing 2 small ocelli; there is a third small acellus in 4. H.W. very small ocelli in 1c, 2, 3, 4, 5 and 6. Discal band curved parallel with the termen and well-defined.

95. (D25·1) **Elymnias hypermnestra caudata**, But.

Will only be found at low elevations where palm trees grow. Common at Kallar in September: also found in May, July, October and December, but is rather scarce then. Caught on the western slopes as well. At Kallar it frequents the edges of the areca plantations, especially on the Coonoor river side.

AMATHUSIIDÆ.

96. (E10·3β) **Discophora lepida lepida**, M.

A rare inhabitant of very thick bamboo jungle; the male only flies in the early morning, evening, and possibly at night, but the female can be seen flying in jungle during the daytime. Both may be flushed in the daytime by penetrating their haunts: they are then easily caught as they do not fly far without settling.

The male can best be taken by sugaring in the early morning. Ormiston states that it may be caught in the same manner as soon as it is dusk. I have only once tried sugaring for it and this was met with instant success. It was at 8-30 a.m. at Kallar, though possibly an hour earlier at that season (Aug.) would be better. My bait was a mixture of toddy, jaggery and beer. In the process of mixing I had collected an attractive odour myself and a male immediately settled on my stocking.

The male has a peculiar odour, to my mind best described as a mixture of tom-cat and jasmine!

I have in my collection two males from Kallar taken on 22-8-'41: I also noticed a female flying at the same place on 31-7-'41.

Mr. Smith of Aruvankadu has in his possession a very fine female of over 100 mm. expanse. This was caught *in the cordite factory* at Aruvankadu at about 6,200′. This seems to me to be a most remarkable record in every way. The foodstuff is bamboo, but there is none of this growing within a number of miles and at a very much lower altitude.

This species has not previously been recorded from the Nilgiris.

Note.—(E7. α) *Amathusia phidippusfriderici*, Fruh.

This is listed as a South Indian species but I have no information of the locality in which it has been caught.

NYMPHALIDÆ.

97. (F1·2β) **Charaxes polyxena imna**, But.

Rare. Five records from Kallar, 1,350′. I have one male which was caught settling on dung, 23/11, and one female caught on 22/8. The other three are in a local collection.

98. (F2·7β) **Charaxes fabius fabius**, F.

Very rare; generally found near water. I have seen one specimen at Kallar, 2-10-'41.

99. (F2·2β) **Eriboea athamas agrarius**, Swin.

Not rare on the ghats up to 4,500′. Settles readily on damp mud. Observed during most months of the year.

100. (F7·8β) **Apatura parisatis atacinus**, Fruh.

Only found in the evergreen country. It is quite common on the upper Mettupalaiyam Ghat between 4,500′ and 6,500′. Recorded in most months.

'Female, very rare; male, not common,' Hampson.

101. (F10·1α) **Euripus consimilis meridionalis**, WM.

'One at lantana, N.W. corner of the Nilgiris, October, 1888,' Hampson.

One specimen caught at Kallar is the only other record of which I know. Extremely rare in the Nilgiris. Rare in Coorg.

102. (F18·3α) **Euthalia lepidea miyana**, Fruh.

Very rare on the southern slopes. One record from Kallar on lantana, 23-11-'41. Three from the Nadgani Ghat at 2,000′ on 23-11-42 where it seems to be much less rare. As far as I know this species has not previously been recorded from the Nilgiris.

103. (F18·14β) **Euthalia garuda meridionalis**, Fruh.

Very rare; one record from the Mettupalaiyam Ghat, season and altitude unknown.

104. (F18·17β) **Euthalia lubentina arasada**, Fruh.

Rare. Appears occasionally at Kallar. Observed in May, October and August of '41 up to 2,500′. Not previously recorded from the Nilgiris.

105. (F18·27β) **Euthalia evalina laudibilis**, Swin.

Scarce, but the commonest of the genus in the Nilgiris. It may be caught at Kallar during most of the year. Observed on the western slopes in October.

106. (F18·28) **Euthalia nais**, Forst.

Rare. Observed at Kallar in March, May, July and October. It has the habit of frequently settling on the ground and never flies far if disturbed.

'Bamboo jungle,' Hampson.

All these five species of *Euthalia* are scarce throughout the Nilgiris and Hampson had only observed *nais*. *Evalina* and *garuda* seem to be common around Bangalore.

107. (F20·β) **Parthenos sylvia virens**, M.

'Common on the western slopes; a rare straggler over the rest of the district' Hampson. One seen flying high at Kallar, 23-11, is my only record from the Southern Nilgiris. It is common on the Nadgani Ghat from October to February.

108. (F24·7β) **Limenitis procris undifragus**, Fruh.

'3,000′ to 4,000′; rare,' Hampson.

I have not yet seen this species; probably confined to the evergreen area.

109. (F25·2α) **Pantoporia nefte inara**, Db.

'3,000′ to 4,000′; rare,' Hampson.

Confined to the evergreen area. Not rare on the Nadgani Ghat in October and February. I have also seen a specimen reputed to have been caught on the Mettupalaiyam Ghat. I have never seen one in the Southern Nilgiris myself.

110. (25·4α) **Pantoporia selenophora kanara**, Evans.

'3,000′ to 5,000′; very rare,' Hampson.

Confined to the evergreen area. It may be taken in small numbers just above Wenlock Bridge on the Coonoor River during March I have seen it nowhere else.

111. (F25·10α) **Pantoporia ranga karwara**, Fruh.

'3,000′ to 4,000′; rare,' Hampson.

Confined to the evergreen area. It may be found in the two nalas at the eastern end of the estate above Runneymede railway station. It may be caught there at the end of February and in early March. I have also seen it in the evergreen area of the Nadgani Ghat in February.

112. (F25·14) **Pantoporia perius**, L.

Rare. Occasional stragglers find their way up as high as Ketti, 6,500′. I have seen it at Kallar in November and at Ketti in May.

113. (F26·1α) **Neptis columella nilgirica**, M.

'3,000′ to 5,000′; not rare,' Hampson.

I have little information about this species except that it is rare in this part of the Nilgiris. I have two specimens: one from Ketti, 6,600′, taken in March and one from the Mettupalaiyam Ghat at 2,500′, caught in October, W.S.F. The markings of the W.S.F. are considerably darker.

114. (F26·2β) **Neptis jumbah jumbah**, M.

Always common to about 4,500′. Also found on the lower plateau in March and April but is not common then.

115. (F26·6α) **Neptis hylas varmona**, M.

Always common on the ghats; common on the plateaux in the dry months.

116. (F26·7α) **Neptis soma kallaura**, M.

Rare; one specimen from the Nadgani Ghat in October.

117. (F26·8α) **Neptis nandina hampsoni**, M.

Hampson doubted whether this species was different from *soma*. It is, however, so different in appearance that it is difficult to understand why he held this view. This butterfly may be taken, in the Southern Nilgiris, in exactly the same place, and at the same season, as *P. ranga karwara*. Similarly, this is the only spot in the Southern Nilgiris where I have seen the species. It may also be taken on the Nadgani Ghat in October, December and February, where it does not seem to be particularly rare.

118. (F26·15α) **Neptis viraja kanara**, Evans.

Very rare in the Southern Nilgiris where I have had only one, from Kallar, 2-9-'42. Hampson had only recorded one and this was from the western slopes. I have also seen a specimen on the Nadgani Ghat, 23-10-'42.

119. (F26·32β) **Neptis hordonia hordonia**, Stoll.

Common all the year round at low elevations. Stragglers find their way up to about 7,000′ in March and October. Hampson says that the D.S.F., *plagiosa*, is caught on the plateau throughout the year.

120. (F27·4α) **Cyrestis thyodamas indica**, Evans.

A fairly common inhabitant of the evergreen region, where it seems to occur throughout the year in suitable weather. I have also seen stragglers at Ketti, 6,500′, in May and February. Only the white form occurs in S. India.

121. (F30·1) **Hypolimnas misippus**, L.

Common everywhere during the dry months.

According to Hampson the female forms mimicking *dorippus*, *chrysippus* and *alcippus* appear.

122. ♀ v. *alcippoides*, But.

Very rare.

4

123. ♀ v. *inaria*, Cr.

Very rare. I have seen one in a local collection.

124. (F30·2) **Hypolimnas bolina**, L.

Not usually common but well distributed from the plains up to 7,000′. Common at Kallar in 1942 in March and April, and below Coonoor in October.

125. (F34·1✓) **Kallima philarchus horsfieldii**, Koll.

'Rare on the northern; not uncommon on the southern slopes,' Hampson. I have found it rare, having but two records myself, 4/7 and 7/12 at Kallar. I have also seen specimens from the same neighbourhood in a local collection. Over-ripe jack fruit is supposed to attract this species.

126. (F35·1✓) **Precis hierta hierta**, F.

127. (F35·2✓) **Precis orithyia swinhœi**, But.

128. (F35·3✓) **Precis lemonias vaisya**, Fruh.

129. (F35·6✓) **Precis iphita pluviatalis**, Fruh.

All are abundant throughout the year on the slopes and common on the plateaux except between June and September.

130. (F35·4✓) **Precis almana almana**, L.

Not as common as the previous members of this genus but it may be caught fairly regularly at Kallar between March and June, and in November and December. Up to 7,000′ in March, April and May.

131. (F35·5) **Precis atlitles**, L.

Not rare at Kallar from January to March. Rare as a straggler up to 7,000′ in March.

132. (F36·1) **Vanessa cardui**, L.

133. (F36·3β) **Vanessa indica pholœ**, Herbst.

134. (F36·4β) **Vanessa canace viridis**, Evans.

Cardui is caught at all altitudes, being very common on the plateaux, but the other two will only be taken at the top of, and above, the evergreen area. All are common and will be caught throughout the year.

135. (F39·1γ) **Argynnis hyperbius hybrida**, Evans.

Common all the year round on the plateaux. Never found below them.

136. (F41·β) **Cupha erymanthis maja**, Fruh.

Mainly confined to the evergreen region, though I have come across it both above and below. Rare at Kallar but quite common at Ketti in March. Abundant at Wenlock Bridge and common on the Nadgani Ghat where it will be found throughout the year.

137. (F42·1) **Atella phalanta**, Drury.

Fairly common everywhere throughout the year.

138. (F44·β) **Cynthia erota saloma**, Swin.

Not rare in the evergreen region but very difficult to obtain in good condition. A rare straggler at Ketti. In the Southern Nilgiris its season is from May to December.

139. (F45·4β) **Cirrochroa thais thais**, F.

Abundant in the evergreen region: not rare at the foot of the hills and up to 7,500′.

140. (F47·2β) **Cethosia nietneri mahratta,** Fd.

Common in the evergreen area of the western slopes where I have caught it from October to December. Hampson states that it is a rare straggler in the rest of the Nilgiris.

141. (F48) **Byblia ilithyia,** Drury.

A common plains butterfly in the country beyond Mettupalaiyum, but rare in the Nilgiris. I have only recorded it once. This was at Ketti, 6,500′, 24-9-'42.

142. (F49·1β) **Ergolis ariadne indica,** M.

Common at Kallar from July to December. Also caught up to 6,500′.

143. (F49·2β) **Ergolis merione merione,** Cr.

Common at Kallar from July to December: very common on the Nadgani Ghat in October and not rare on the lower plateau in the dry months.

144. (F52) **Telchinia violæ,** Fab.

Common throughout the year on the ghats: fairly common on the lower plateau between March and May.

Note.

(F2·1*a*) **Eribœa schreiberi wardi,** M.

A very rare butterfly caught both in Coorg and Kanara. It is reasonable to expect that it appears on the western slopes.

(F18·10) **Euthalia telchinia,** Men.

Has been caught once in Coorg. Very rare indeed and unlikely to be taken in the Nilgiris.

(F33·β) **Doleschallia bisaltide malabarica,** Fruh.

Appears in Kanara and Coorg. Very rare but probably appears in thick jungle on the western slopes of the Nilgiris.

(F42·2β) **Atella alcippe mercea,** Evans.

A very local butterfly that appears in Coorg and Kanara. May possibly be found in the Nilgiris.

Erycinidæ.

145. (G1·3α) **Libythea lepita lepitoides,** M.

Common at times up to 3,500′. It often settles in very great numbers on damp sand at Kallar. I have also seen it on the Nadgani Ghat. Found during most months of the year.

'Rare,' Hampson.

146. (G1·4β) **Libythea myrrha carma,** Fruh.

Found in, and above, the evergreen region. I have also one specimen from Kallar, but its appearance there is most unusual.

It comes to water like lepita but is not usually common except in October below Coonoor. Also observed from February to June.

147. (G4·5α) **Abisara echerius prunosa,** M.

Common in evergreen forest. I have observed it in February and March, and from August to December.

(To be continued.)

A SKETCH OF THE BOTANY AND GEOGRAPHY OF NORTH BURMA.

BY

F. Kingdon-Ward, B.A., F.R.G.S., F.L.S., ETC.

(*Founder's Medal, Royal Geographical Society, Livingstone Medal, Royal Scottish Geographical Society, Victoria Medal of Honour etc.*)

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I. Introduction

The following work claims to be no more than its title suggests, an outline sketch, which others must fill in, written on the lines of a previous Sketch of the Botany and Geography of Tibet.[1] It is a foundation, solid I hope, on which another generation of field botanists may build.

I have attempted to summarise and to put in order our very scanty knowledge of the vegetation of a small part of Burma as politically defined, but a part peculiarly rich in plants. I have confined myself to a brief description of the units of vegetation, a sufficiently difficult task. No attempt has been made to write a flora of North Burma; the materials do not exist, although this is a contribution towards a flora also. Species, or more frequently genera, are mentioned only in so far as they define and illustrate the vegetation types which occur at different altitudes. I have however mentioned most of the known endemics.

There are at least 6,000 species of flowering plants and vascular Cryptogams in North Burma. It is for its size one of the richest areas in the world, richer than Sikkim which possesses fewer species of Chinese affinity. Wedged between the Eastern Himalayas and the mountains of western China, it seems to possess the best of both worlds. Southwards it is in direct contact with the Indo-Malaysian region, northwards it continues into Tibet.

The great majority of North Burma plants remain unidentified. Even of those collected, by no means all have been identified. Some of those named here I have identified or described myself while working and travelling in the country. But the majority, including most of the endemic species, have been named and described by the staffs of the Botanical Department, Natural History Museum, London, of the Royal Botanic Gardens, Kew, of the Royal Botanic Gardens, Edinburgh, and by Dr. E. D. Merrill, Director of the Arnold Arboretum, Harvard, U.S.A., and his associates. I am particularly indebted to the following botanists for their identifications, some of which have been published from time to time in Notes from the Royal Botanic Gardens, Edinburgh, the Kew Bulletin, and elsewhere: the late Professor Sir I. Bayly Balfour, Sir W. Wright Smith, Regius Professor of Botany, Edinburgh, Dr. W. Edgar Evans, Dr. George Taylor, Mr. H. K. Airy Shaw, Mr. J. Hutchinson, Mr. C. E. C. Fischer and Dr. E. D. Merrill. If more species from the higher zones are named, that is mainly because most of my explorations having been at high altitudes. I know the alpine flora better than the forest flora.

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[1] Journal of the Lennian Society (Botany) 1930.

I have used the word 'Botany' in the title intentionally, for its vagueness; a sketch *is* vague.

There is perhaps the germ of a future flora here as well as an analysis of the topography in relation to the vegetation and the origins of the North Burma Flora.

I confess I have been unable, not for want of trying but for want of knowledge, to fit the North Burma forest types, with their rapid altitudinal changes into Champion's excellent Indian Forest Types. Future workers will no doubt do this. On the basis of present knowledge there appears to be nothing quite like our North Burma forest, unless it is the forests of North-East Assam. This justifies the use of what appears to me to be the most appropriate names for easily recognised types, not quite in accordance with Champion's nomenclature.

In the course of my travels in North Burma I have collected over 2,000 species of flowering plants, and have introduced more than 100 species into cultivation, yet there remain large areas I have never been into. Nevertheless, as I have said there is something here for the future botanist-explorer to work on, a starting point with a solid basis of fact, with only enough of theory to whet the appetite of the true investigator.

This monograph was almost complete when I was in Singapore in 1941. Six weeks before the Far Eastern War broke out I went on a special mission to Burma. I did not return to Singapore and my manuscript together with the diaries of my four most successful journeys in North Burma, were destroyed or passed into enemy hands. It has been a difficult task to rewrite the whole with inadequate notes. Fortunately a short paper I wrote on the botany of the Hpimaw and Htawgaw hills had recently been published in America (though I have not seen this) with a list of plants collected on the Vernay-Cutting expedition of 1938-39, identified and described by Dr. Merrill. This served as a nucleus. The loss of my diaries was however irreparable and the present work is not so complete as the original.

II. Previous Work.

The earliest Europeans to visit North Burma were Lieutenants Wilcox and Burlton (1826), Colonel Woodthorpe and Major Macgregor (1885) and Errol Gray (1892-93). All of them came from

Assam into the Bor Hkamti country (Hkamti Long) via the Chaukan and Hpungan passes, and three of them, Wilcox, Macgregor and Errol Gray, wrote detailed reports of their journeys, which are of great value and interest. Yet they tell us nothing of the botany of the country. The next traveller was Prince Henry of Orleans who, in 1895, crossed from Tonkin to India via Yunnan and North Burma. Though he collected a number of plants in the course of this long journey, only two of them are recorded as coming from Burma.

It is not till 1897 that we get our first glimpse of the flora of this most interesting and remote region from Lieutenant Pottinger. A brief account of Pottinger's journey and a full account of the plants collected or noted is given by Sir David Prain.[1] Unfortunately Pottinger got into trouble with the Maru tribe who murdered some of his followers, and he had to make a quick getaway, abandoning most of his baggage, including his natural history collections. Thus the result, though not negligible, was not so good as it might have been. Pottinger's route was up the valley of the Nmai Hka to the Laking river, and back via the Wulaw pass, the Ngawchang Hka, and the Htawgaw hills, nowadays the best known district, so far as the natural history is concerned, of North Burma. At the time of this journey, Lieut. Cruddas, stationed at Myitkyina, was collecting on the plain.

In the second decade of the present century we began to accumulate real knowledge of this region, its geography and natural history. The railway to Myitkyina was completed about 1910. In 1906 Mr. E. C. Young crossed North Burma from east to west in the course of a rapid journey from Yunnanfu to Sadiya. Mr. Young's route lay through the 'triangle' some distance south of Prince Henry's; but he too is silent on the subject of natural history. It is remarkable that up to this date, all travellers who visited Hkamti Long should have approached it either from the east or from the west, never from the south.

A few years before the outbreak of the first world war however the Government of Burma suddenly began to take an interest in Hkamti Long; not because it attracted them *per se*, but because they found that China was also interested in it. It gave the Government a shock to discover that the Hkamti Long plain, which was almost at their back door so to speak, could be reached without the caller making himself known at the front door. Several semi-military expeditions were therefore despatched to the plain, travelling from Myitkyina via the Hukawng valley and the Mali Hka valley. Captain B. E. A. Pritchard explored independently, following Pottinger's route up the 'Nmai Hka valley. In 1913-14 Hkamti Long was permanently occupied for the first time; then, in the golden age of British horticulture from 1914 to 1939, botanical explorers began to collect plants in the mountains near the sources of the Irrawaddy. Two areas became well known: the Hpimaw and Htawgaw hills and the plain of Hkamti Long. In those early years only one other district was visited, the Taron valley, but that by a first class botanist,

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[1] Records of the Botanical Survey of India.

Dr. Handel-Mazzetti of Vienna, in 1916. He was the first to describe some of the plant communities and associations.

In 1919 Messrs. R. Farrer and E. H. M. Cox visited the Hpimaw Hills and collected several hundred herbarium specimens and seeds. In the following year Farrer went further north to the Ahkyang valley, where he died. An account of these two seasons' work is given by Cox.[1]

Between 1917 and 1930 the late Mr. George Forrest frequently sent native collectors from his base in western Yunnan into North Burma. They worked on the Taron-Salween, 'Nmai Hka-Salween, Shweli-Salween divides. Mr. Forrest's collections from the eastern side possibly outnumber those of all other collectors from North Burma put together. By reason of the vagueness and inaccuracies of the native collectors' reports, however, it is often impossible to identify the localities. The altitudes recorded are as misleading as the localities. Many of Mr. Forrest's specimens labelled Tibet are really North Burma plants, though they may grow also in the adjacent parts of Tibet; for this reason I have not made as much use of this source of information as I should have liked to.

In the early spring of 1939, Mr. Kermode, Burma Forest Service, visited the Htawgaw and Hpimaw Hills, and collected several hundred plants. Reference must also be made to Mr. J. H. Lace, I.F.S., and to that enthusiastic amateur, Lady Wheeler Cuffe, who both added to our knowledge of the wealth of flora in the hills east of the Nmai Hka, the former in 1906, the latter between 1912 and 1920. Several other officers of the Frontier Force (or Military Police as it was then) of the Frontier Service, and of the Indian Forest Service, have contributed something to the stock of knowledge; the name of Maung Kyaw, a Burmese Forest Officer, deserves to be remembered.

My own journeys in North Burma took place in 1914, 1919, 1922, 1926, 1930-31, 1937, 1938-39 and 1942. In 1914, I explored the Hpimaw district, and travelled up the Nmai Hka valley, crossed over to the Hkamti plain, and returned to Myitkyina via the Mali valley. In 1919 I was again in the Htawgaw and Hpimaw hills. I also marched round the mountain called Imaw Bum and ascended several times to the summit. In 1922 I crossed into North Burma from north-western Yunnan, over the Taron-Salween divide, reached the Taron for the first time and continuing south-east reached Hkamti Long via the Nam Tamai for the second time. Then in 1926 I went from Myitkyina via Hkamti Long to the Nam Tamai, explored the Seinghku valley, crossed the Diphuk La, and reached Sadiya in Assam via the Lohit valley. In 1930-31, with Lord Cranbrook I went up the Adung valley to the source of the Nam Tamai, and crossed the Namni L'ka into Tibet; and in 1937 I went up the Audung for the second time, visited the snow peak Ka-Karpo Razi, and explored the ridge between the Nam Tamai and the Dablu, finding many new plants. In 1938-39 I was with the Vernay-Cutting expedition to the Hpimaw and Htawgaw hills for the third time; and by collecting throughout the cold weather, added to our knowledge of this by now the best known district of North Burma. In 1942, I visited the Hkamti plain from Myitkyina once more, and later went to the Seinghku valley, and over the Diphuk La. On this occasion, though I did not collect plants, being otherwise fully occupied, I was able to make further observations on the flora and vegetation.

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[1] Farrer's Last Journey.

Not less important than the collectors' work has been that of the taxonomists into whose hands the specimens eventually came. Their names, or some of them, have already been mentioned.

III. GEOGRAPHY.

North Burma as here understood, the scanty population of which though mostly belonging to the Tibeto-Burman family is not Burmese, comprises the whole upper Irrawaddy basin. It extends from the south of Myitkyina, where the dry zone flora of central Burma passes into evergeen forest, almost to the ultimate sources of the Irrawaddy.

About 20 miles north of Myitkyina the Irrawaddy splits into two, a western branch (Mali Hka) and an eastern branch ('Nmai Hka). The latter is the main stream. Politically Burma does not quite reach to the sources of the 'Nmai Hka which rises in the south-east corner of Tibet. But geographically the Taron or upper course of the 'Nmai, though within Chinese territory, must be included in the natural region of North Burma to which it belongs. Only the extreme source of the Taron is excluded and that on geographical, not on political grounds. In the west the Hukawng and Chindwin valleys are doubtfully included. It is however convenient to draw the southern boundary of this very natural region along the 25th parallel of latitude, and by extending it westwards, to embrace the eastern flank of the Patkai range thereby including the peak of Saramati. Possibly all the country west of the Kumon Range (i.e. the Chindwin basin) should be excluded, on the ground that the flora is more Assamese than Burmese and the climate such that deciduous rather than evergreen forest prevails. That is certainly true of the lower Chindwin. But since the Patkai range is botanically unexplored, we cannot be sure of its status. Should it appear later that the Chindwin area belongs rather to east India, it will be a simple matter to exclude it. Again a good case could be made out for including all the hilly country east of the Irrawaddy up to the China frontier, at least as far south as Bhamo, within the North Burma region. I have not done so because here the flora appears to be more closely linked to the Shan flora than to that of North Burma. This also can easily be adjusted later, as knowledge increases. Thus a parallelogram bounded by the parallels of 25° and 28° 30′ and by the meridians of 94°30′ and 98°40′ will completely enclose North Burma, the superficial area of which is about 40,000 square miles. The gross area is of course much larger.

The limits given above may at first sight appear somewhat arbitrary. Yet they have at least some scientific foundation and are not simply a convenience.

North Burma is here treated as a sub-region of the Sino-Himalayan region, not as a sub-sub-region of the Indo-Malaysian region. It is regarded as detached from Burma proper, much as peninsular India is detached from the Himalayas. The reason for this somewhat unorthodox treatment is that the flora of North Burma as a whole has been directly affected by the Pleistocene glaciation. It is true that an Indo-Malaysian flora is predominant in the southern half of the territory. Even so it is a different type of flora from the dry (monsoon) deciduous forest flora which prevails over a large part of Burma. Moreover the North Burma tropical evergreen forest includes a number of Chinese and East Asiatic plants. The bulk of the North Burma flora is however not Indo-Malaysian, but overwhelmingly Sino-Himalayan and East Asiatic.

Sino-Himalaya comprises the entire mountain region from Kashmir to Western China, including Tibet and the mountainous parts of what are politically Assam and Burma. The whole of this great region sandwiched between Indo-Malaysia, Central Asia, and the East Asiatic region was directly influenced by the Pleistocene glaciation. It became a frigid desert. Then in later times, when the ice had been vanquished, into this botanical vacuum poured streams of plants from several directions, till it became one of the richest regions in the world, particularly at its eastern end.

North Burma is a mountainous well watered region with a heavy summer rainfall and moderate warmth, cool or cold winters and high all-the-year-round humidity. The *average* elevation is several thousand feet, but that gives no idea of the height and steepness of the mountains, the depth and narrowness of the valleys, or the varied nature of the scenery. The only flat land north of the Myitkyina plain is the Hkamti plain, covering some 200 square miles and entirely surrounded by mountains. There is every reason to believe however that North Burma is really the relict of a lofty undulating plateau continuous with the Yunnan plateau to the east and the Tibetan plateau to the north. During the last million or so years the surface has been ploughed by ice, then eroded by water, till to-day it is so deeply dissected in all directions as to have lost all outward resemblance to a plateau.

North Burma includes the following place names. Most of these names recur frequently in recent botanical literature. In the eastern Irrawaddy area: the Htawgaw and Hpimaw hills, Imaw Bum, Ngawchang and Ahkyang valleys, Taron gorge, Nam Tamai, Seinghku and Adung valleys; the Salween-Irrawaddy and Shweli-Irrawaddy divides, the Lohit-Irrawaddy divide.

In the western Irrawaddy area: the Mali Hka valley, Sumpra Bum, Plain of Hkamti Long (Putao, Fort Hertz) Mali Hka valley, Nam Tisang valley, Kumon range, and the 'triangle'.

In the Chindwin area: the upper Chindwin and Hukawng valleys, the Patkai range, and Saramati peak.

The chief mountain ranges from east to west are as follows: the Salween-Irrawaddy divide, forming the eastern boundary of the territory, with its southern offshoot the Shweli-Irrawaddy divide; the 'triangle' range or Mali-Nmai divide; the Kumon range; the Patkai range forming the western boundary of the territory. Somewhat isolated in the north is the Tamai-Taron massif.

The Salween-Irrawaddy divide is a prominent feature for more than 200 miles: even in the extreme south it rises to over 10,000 feet in the extreme north to nearly twice that height. Immediately south of Htawgaw the Shweli river rises and the Shweli-Irrawaddy divide then becomes the frontier for 90 miles to the neighbourhood of Sadon. The 'triangle' range branches off from the Patkai range south of the Diphuk La in lat. 28° and runs south-east for a short distance before entering the 'triangle' and turning south; it ends abruptly at the confluence of the eastern and western Irrawaddys, thus forming the backbone of North Burma. Throughout its length it is much closer to the 'Nmai Hka than it is to the Mali Hka. West of the Nam Tamai are peaks of 15,000 feet; the average height then drops rather suddenly to 8,000-9,000 feet, till just south of lat. 27° when it again rises to over 11,000 feet.

The Kumon range diverges from the Patkai at the Chaukan pass, near Fort Hertz, and runs south to the neighbourhood of Myitkyina where it ends in a peak 7,954 feet high. Immediately south of the Chaukan pass are a few peaks of over 11,000 feet; but throughout the greater part of its length the Kumon range hardly exceeds 6,000-7,000 feet.

The Tamai-Taron massif comprises a block of mountains between those two rivers from the northern end of which rise two short rivers, the Dablu and Tazu, sandwiched between the Nam Tamai and the Taron, south of the Adung valley. The highest peaks are about 15,000 feet, and the several ridges which separate the four rivers have a crest line of 11,000-12,000 feet. North of lat. 28° the mountains with the exception of a constellation of peaks exceeding 19,000 feet, maintain a uniform level of 15,000-17,000 feet, showing very clearly their plateau origin.

Ka-Karpo Razi is the name given to a range of needle-like rocky peaks situated at the sources of the Adung river, at the extreme northern tip of the territory. Four of these peaks all situated within a radius of 10 miles exceed 19,000 feet. On the north slopes are big glaciers.[1]

Lastly, the Patkai range takes a general south-west trend. In the north it is the Lohit-Irrawaddy (i.e. Brahmaputra-Irrawaddy) divide, and it is here that the snow peaks of Ka-Karpo-Razi, the highest mountains in Burma, are situated. South-west of the Chaukan pass this range falls rapidly in altitude, but just south of lat. 26° it suddenly attains 12,553 feet in the isolated peak of Saramati, which rises over 2,000 feet above its neighbours.

East of the Kumon range is a jumble of low hills from 2,000 to 5,000 feet high, cut through by small rivers flowing into the western Irrawaddy. Through this tangle of hills and valleys runs the road from Myitkyina to Sumpra Bum and Fort Hertz.

Mountain ranges have breadth as well as length and height. Most of the North Burma ranges are conspicuously narrow for their length, but the Irrawaddy-Salween divide for a hundred and twenty miles measures from crest line to the 'Nmai Hka 25-30 miles, with another 10-15 miles on the Salween flank. It is cut through by four large and several small tributaries of the 'Nmai Hka which for three quarters of their course flow north or south, *parallel* to the main river, before joining it. They thus block out a series of lesser parallel ranges in ascending order of altitude from main river to main divide. North of lat. 28° however from crest line to river (Taron) the range does not exceed 10 miles; but here the Taron-Salween divide makes up in height what it lacks in breadth.

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[1] The Irrawaddy Plateau, Geographical Journal, Oct. 1939. Himalayan Journal, 1939.

It will help us to undertsand the present physical appearance of the country if we remember that it forms the south-eastern fringe of the Tibetan escarpment. Since no high land stands between it and the Bay of Bengal, however, it catches the full force of the monsoon and has been heavily eroded. Hence as remarked above all appearance of a plateau except for the tell-tale level topped parallel ranges has been lost.

But this is not the whole story. There is ample evidence from the shape of the valleys and the planing of the rocks that the entire area as far south as 25° 30′ on the east side at least was glaciated in Pleistocene times. It was the Pleistocene glaciers which initiated the river pattern. The degraded plateau now consists of two layers or storeys, the upper ice worn storey, comprising the original plateau, and an under or ground storey, which is water-worn and has gone far to mask the original structure. The water-worn storey comprises the whole mountain area up to 7,000 or 8,000 feet and owes its shape to running water. It is occupied largely by an Indo-Malaysian flora mixed with a strong Chinese element, especially along the eastern border. The upper storey, from 7,000-8,000 feet to 12,000-14,000 feet has been shaped by ice and is all that remains of the original plateau. It is occupied mainly by a Sino-Himalayan flora. Thus North Burma is a twice degraded plateau.

Since the mountains are higher in the north and east, lower in the south and west, we may infer that the ancient plateau had a general slope to the south-west.

Rivers.—The two main rivers have already been mentioned. The Mali Hka has its source in the Irrawaddy-Lohit divide north of the Hkamti plain, whence rise the four streams which give the river its local Shan name of Nam Kiu. The highest peak hereabouts, Noi Matwe, over 15,000 feet, is visible from Fort Hertz. All four streams rise south of lat. 28° and unite before they enter the plain. South of Fort Hertz the Nam Yak, rising in the western range, joins in; its broad valley forms the southern boundary of the plain. Still further south the Mali Hka receives a number of small tributaries from the Kumon range which need no description. Immediately north of the 'triangle' it receives its largest tributary, the Nam Tisang from the north-east. Other small tributaries flow from the Mali-Nmai divide; they would be even smaller than they are but for the urge all the rivers of North Burma have to flow parallel to the north-south grain of the country.

The 'Nmai Hka rises in four almost equal rivers amongst snow mountains situated north of 28° 30′ in Tibet. These four glacier fed rivers unite to form the Taron, the main source stream of the Irrawaddy. In lat. 27° 50′ the Nam Tamai, a large river from the north-west, joins the Taron, which here makes a pot hook, flowing in from the south-east. Two other shorter rivers join the Taron immediately east of where the Nam Tamai parts company from it, both flowing from the north. These are the Dablu and Tazu just referred to rising from the Tamai-Taron divide. These four rivers—the large Taron and Tamai, and the small Dablu and Tazu—make up the 'Nmai Hka or eastern Irrawaddy. The Nam Tamai has one short important tributary, the Seinghku, which rises on the Irrawaddy-Lohit divide north of the Mali Hka and flows south-east. Above the Seinghku confluence in lat. 28° the Tamai is known as the Adung. Within a few miles the Adung breaks up into a number of streams which rise amongst snow beds and glaciers. Here, at the tip of North Burma, the average elevation over an area of 11,000 square miles is 10,000-12,000 feet. At the head of the Adung valley is the difficult Namni Pass into Tibet.

The 'Nmai Hka receives four large and a number of small rivers on its eastern bank, flowing from the Irrawaddy-Salween divide. These are from north to south: the Ahkyang, the Mekh, the Laking and the Ngawchang. High as it is, the crest of the divide is only 30 miles distant from the 'Nmai Hka, but these tributaries, as already remarked, tend to follow the grain of the country, thus enlarging their catchment areas. The peculiar courses of many of the rivers, including the Taron, Adung, Ngawchang, and others is easily explained with reference to the early glaciation. That is to say, the river pattern was originally fitted to a glaciated plateau and only later adapted itself to a water eroded plateau. It is therefore hardly surprising if the adaptation did not quite fit, after being lowered some 5,000 feet. Thus while there is always snow water in the 'Nmai Hka, which has its ultimate sources, both of the Taron and of the Nam Tamai amongst glaciers, there is snow water in the western Irrawaddy only between December and July. Possibly the former is always a few degrees colder than the latter.

The plain of Hkamti Long has been mentioned. It covers an area of some 200 square miles near the sources of the Mali Hka, no part of it being more than 1,600 feet above sea level and much of it only 1,400 feet. Enclosed by mountains, those to the north and west more than 10,000 feet high, it is completely isolated. Only the narrow Mali valley connects it with the Myitkyina plain. In Pliocene times the Hkamti plain was probably a lake bed, which during the deglaciation of North Burma, began to silt up. At about the same time a stream cut a channel through the southern ranges of hills, thus draining the lake and forming the Mali Hka.

There are no other plains in North Burma, except the Hukawng valley, nor are there any lakes except a few very small glacier lakes in the alpine region.

The whole of this tangled region of steep mountains and deep gorges is covered with broad leafed evergeen or with Coniferous evergreen forest, only the tops of the higher ranges rising above the 12,000 feet tree line.

Unexplored country.

No part of North Burma is less known botanically than the 'triangle' the most interesting part of which, namely, the Mali-Nmai divide, is a complete *terra incognita*. At the northern end of the range are peaks nearly 12,000 feet high where many alpines must find refuge. A strange Iris has been reported from that area by Mr. St. C. Bartholomew.

Equally unknown is the Kumon range. Pines grow on the Chaukan pass; I have seen only dead saplings, brought back under the impression that they might grow on the Hkamti plain. There is no doubt of its being *Pinus excelsia*. South of the Chaukan pass are peaks over 11,000 feet high. Again the Patkai range west of the Chindwin and the Irrawaddy-Lohit divide north-west of the Hkamti plain are completely unexplored.

Turning to the eastern Irrawaddy, the valleys of the Laking, Mekh and other rivers which have gnawed their way into the Irrawaddy-Salween divide are virgin ground, and so also are the valleys of the Dablu and Tazu together with their dividing ranges.

These are the principal areas, amounting to perhaps 4/5 of the whole territory, about which we know nothing. But the rest of North Burma has been so little explored that a vast amount of collecting and observation could profitably be done there. Even the Htawgaw and Hpimaw Hills, the Seinghku, Adung and Taron valleys and the Irrawaddy-Salween divide, where most of the 20th century collecting down to 1939 has been done, are very imperfectly known. The road from Myitkyina to Fort Hertz, the Nam Tamai valley, and other frequently trodden paths, have been scarcely more than glanced at in passing; the same is true of the Hkamti plain. Saramati is a closed book, if not a close preserve; nor would a knowledge of the flora in numerous widely dispersed localities, if we possessed it, enable us to form an adequate picture of the whole. That might be, and in fact probably is, true for example over the vast area of the Amazon basin, or any similar area subject to an equable climate with no important changes of elevation, such as the black soil steppes of Russia or the flat semi-desert region of Mesopotamia. In none of these places is there any reason why the flora should vary appreciably from one hundred square mile block to another, except in so far as the soil is wet or dry. In fact a sample plot of a few score square miles might represent a cross-section of the whole, in any of these places. In North Burma this is not so. Experience shows that scattered throughout a number of well dispersed species—different for each zone—are many species of more restricted range, and not a few endemics. Nor will our knowledge be completed with the discovering of all the endemics in North Burma; there are far more species to be found new to Burma than new to science. Until we know a good deal more about the distribution of species and their occurrence or non-occurrence in North Burma our knowledge remains very imperfect.

When we remember that India, the Himalayas, China, Tibet and Malaysia as well as places even further afield have contributed to the flora of North Burma we cannot be surprised at constantly finding both new species and species new to Burma, in this much mutilated region. Neither in the alpine zone nor in the sub-tropical valleys, least of all perhaps in the middle zones, have we collected more than a fraction of the existing species.

The above remarks apply to the flora of North Burma; but with some modification they apply almost equally to the fauna. We probably know pretty well what mammals, especially of the larger mammals occur. We know too something about the birds. But as we descend the scale our knowledge dwindles rapidly.

So far as bird life is concerned however, apart from our ignorance concerning the habits and status of many species recorded, I cannot endorse the opinion of the author of 'The Birds of Burma', who in the Introduction states with remarkable complacency that 'the chances of meeting with a bird not described in this book are remote, except possibly in the extreme east of the Shan States or the extreme south of Tenasserim.' This at any rate is not the opinion of Col. J. K. Stanford who certainly knows more about the birds of North Burma in the field than any other living person (see his introductory remarks in the *Ibis*, 1939, 'On the Birds of Northern Burma'). Nor is it mine. I would wager I could find 50 undescribed birds in North Burma. The map in 'The Birds of Burma'—the only blemish in an otherwise excellent summary—where the Adung valley is shown as filling the entire sources of the *western* Irrawaddy, is partly responsible for this surprising claim. Evidently the author has been quite unable to visualise North Burma. Possibly no one who has never been north of Myitkyina could.

IV. Climate.

General Remarks.—We have practically no meteorological records from North Burma. I give the rainfall records for the only three stations where they were kept and these have a certain value; but their application is limited. Rainfall varies in mountainous regions almost as much as maximum or minimum temperatures vary, and it will be noticed that they are far from constant year by year. There is however one factor, and that the most potent single factor controlling the vegetation, which tends to keep fairly constant over the whole area, and at every season, namely humidity. Here again, except for scattered observations, we have no instrument records. However the monthly rainfall figures and still more the appearance of the vegetation itself, prove a high degree of humidity, as well as the absence of prolonged drought. Nowhere, for example, does dry monsoon forest, as seen in the lower Chindwin valley, prevail. Deciduous trees form a small proportion of every forest type met with; but each season has its own deciduous species, they do not all cast their leaves at the same time. Some lose them in the cold, others in the hot weather, while yet others are bare for a short period during the rains. These last probably have a leaf-shed rhythm of less than 12 months—it may be 8 or 10 months only, so that in course of time the tree is leafless during each month of the year. The prevailing forest type, whether broad leafed or Conifer, is evergreen.

All that can be said of the climate of North Burma must be said in general terms. High summer temperatures (up to 98°F. on the Hkamti Plain), cool winters, with frost above 5,000 feet and thick mists and heavy dew in the low lying valleys, heavy rainfall between April and October, with heavy winter snowfall above 9,000 feet, and an increasing winter rainfall as one recedes from the plains, and always and everywhere a high humidity, highest in the hot valleys in summer. Humidity is higher on the Hkamti plain, which is closely surrounded by mountains than it is for example at Myitkyina, which lies outside the high country.

The factors which influence vegetation, besides humidity, are maximum and minimum temperatures (which largely control the germination of seeds), annual distribution of rainfall, and light; and in a lesser degree, wind and snowfall (as a protecting agent). Light depends chiefly on aspect and steepness of slope. The midday sun is never less than 40° above the horizon. On mid-summer day it is about 4° from the zenith at Putao, that is, it is almost vertically overhead. Many of the above factors directly depend upon altitude and vary with it.

Alpine Region.—Above 10,000 feet, persistent rather than heavy summer rain, is the rule. The rainfall is certainly not so high as on the Hkamti plain. In the Seinghku valley at 12,000 feet, dry air comes sweeping over the pass from the Tibetan plateau, and not infrequently near the pass one is in sunshine above the cloud, with steady rain falling lower down the valley; and this in the wettest months of the year!

In the Burmese alps the cloud layer has an almost daily vertical movement throughout the summer. At night the cloud sinks down into the deep valleys leaving the peaks clear. By day, the heated air in the valleys drives the cloud up. Thus it tends to rain more in the valleys by night and more on the mountains by day. Winds, though occasionally strong, are usually local. The only winds approaching gale force I have ever experienced in North Burma were in deep gorges such as the Adung gorge.

Above 10,000 feet snowfall in the north and east is heavy. Even so low as 10,000 feet snow beds persist in the Seinghku, Adung and other large valleys till June or July. Such snow beds however owe their existence to the depth and narrowness of the valley and the steepness of its sides. The flanks themselves, particularly the exposed side, are free of snow which, loosened by the warm wind, slides down and piles up at the bottom of the valley to a depth of twenty or thirty feet. At 12,000 feet these accumulated beds persist till August or September and at 13,000-14,000 feet are permanent. These permanent snow beds are not however glaciers; they do not flow. There is not enough depth of snow and consequently insufficient pressure to convert the snow into ice. If more snow fell each winter than melted in the succeeding summer, the snow beds would gradually increase in size and depth until eventually they became glaciers. If less snow fell than melted each year, they would dwindle and finally disappear. Probably they are in a state of equilibrium for the time being, as much snow falling in winter as melts in summer; but it is obvious that down to very recent times more snow has melted than has fallen each year since only recently (on the geological time-scale) these snow beds were glaciers. In other words, the climate of North Burma is passing through a warm moist or inter-glacial phase.

The permanent snow line stands at about 16,000 feet, and peaks of 17,000 feet or more usually have small glaciers at least on their north flanks. So precipitous are the higher mountains however—veritable steeples—that peaks of 16,000 and 17,000 feet are sometimes clear of snow throughout the summer.

In general terms then one may say that the climate of North Burma taking it all in all is moist and warm in the lowest valleys, moist and cool at the middle levels, moist and cold above 9,000 feet. The heaviest rainfall occurs in spring and summer; but enough rain (or snow) falls in autumn and winter to keep the humidity high. Even in the finest weather there is heavy precipitation of dew. Drought is unknown.

The tables on pages 563, 564 and 565 show the rainfall for ten years or more for three stations :

(*i*) Myitkyina, (*ii*) Sumpra Bum, (*iii*) Putao (Fort Hertz).

The general features of the climate which are reflected in the vegetation are given under each zone.

V. ORIGIN OF THE FLORA OF NORTH BURMA.

The composition of the vegetation (i.e. the flora) is closely bound up with its origin and hence with the recent geological history of North Burma. Nor need we probe far back to find a time when the present flora was not there, for it clearly represents a new order, the result of a tragic persecution. The original mountain flora was either exterminated or driven out of North Burma by the Pleistocene glaciation of the Irrawaddy plateau, and we can only guess what that early flora was like. Perhaps it was not so very different from the present flora, though probably poorer in species. It is worth mentioning that in the Mali Hka valley between Myitkyina and Fort Hertz, where the rocks are soft sandstones with bands of clay and pebble beds, are preserved leaf impressions, possibly fruits and seeds also, which when studied may throw some light on this problem.

Whatever the flora may have been in preglacial times, today it is a strange medley of Indo-Malaysian, East Asiatic, Sino-Himalayan and Palaearctic species. The tropical flora is almost pure Indo-Malaysian, the alpine flora almost pure Sino-Himalayan. Between these extremes the temperate flora includes a considerable number of East Asiatic species, besides Palaearctic, together with a larger proportion of endemics than either of the other two zones, so far as we know at present. Thus the flora of North Burma is stratified both in space and time, according to when each element entered the country.

The great highland mass of Sino-Himalaya wedged between the Central Asian, East Asiatic, Indo-Malaysian and Mediterranean regions supports a mainly northern flora. It forms a barrier between Central Asia and the southern peninsulas, but it is also a carrier between East and West. In fact it is the link between all the botanical regions of Asia. Hence it includes also East Asiatic and Himalayan elements. Most of the Sino-Himalayan endemic genera such as *Cyananthus*, *Nomocharis*, *Notholirion*, *Omphalogramma*, *Berneuxia*, *Oreosolen*, *Crementhodium* and many others, occur in North Burma. There are also numerous endemic species of such characteristic Sino-Himalaya genera as *Rhododendron*, *Primula*, *Corydalis*, *Androsace*, *Meconopsis*, *Gentiana*, *Pedicularis*. Nevertheless there are

RAINFALL : MYITKYINA

Year	January	February	March	April	May	June	July	August	September	October	November	December
1932	0·04	1·53	1·63	0·80	8·27	38·16	16·49	21·60	8·45	5·14	4·46	0·02
1933	0·09	0·03	0·03	0·96	8·18	15·20	23·39	22·32	9·20	8·36	0·25	0·10
1934	0·08	2·04	0·15	1·29	4·16	16·42	33·84	21·68	7·80	6·58	4·39	0·09
1935	0·00	0·64	0·00	1·12	0·55	22·11	12·41	27·65	11·92	6·44	1·24	0·00
1936	0·13	2·13	0·27	1·26	9·14	7·33	23·07	13·98	10·39	6·83	0·32	0·22
1937	0·00	0·59	0·06	2·35	11·58	23·75	14·37	18·07	10·71	1·40	0·03	5·65
1938	0·83	0·83	1·49	1·82	9·87	20·58	23·98	18·31	8·24	6·81	3·07	0·00
1939	0·01	0·89	0·55	0·92	6·00	14·80	18·76	15·87	13·30	3·56	0·09	0·10
1940	0·00	1·02	3·81	0·07	5·57	9·97	17·20	13·09	12·96	3·65	1·74	0·73
1941	0·15	1·71	0·59	0·99	10·72	32·68	20·65	17·27	18·48	2·61	0·62	0·53

Rainfall recorded in Myitkyina (600 feet) for the years 1911–41.

Year	*In.*	*Cents.*
1911	93	36
1912	86	85
1913	77	19
1914	75	05
1915	98	03
1916	73	91
1917	67	57
1918	90	80
1919	78	02
1920	83	81
1921	93	71
1922	72	78
1923	87	98
1924	77	84
1925	78	99
1926	99	54
1927	106	20
1928	105	41
1929	77	68
1930	82	83
1931	80	19
1932	106	59
1933	88	11
1934	99	02
1935	84	08
1936	74	99
1937	88	56
1938	95	83
1939	74	85
1940	69	81
1941	105	25

Max. Rainfall—106·59 in. 1932 } 31 years.
Min. ,, 67·57 in. 1917 }
Average for 31 years—85·74 in.

RAINFALL: SUMPRA BUM

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
1931	0	10	4	7	7	31	56	25	10	7	1	2	160	Rainfall Record for Sumpra Bum, Alt. 3,500 ft. Average for 11 years, 141·18. Average for decade 1932–1941, 139·30. Max. rainfall 177 in. 1938. Min. rainfall 104 in. 1932.
1932	0	3	6	3	10	22	21	15	15	5	3	1	104	
1933	0	1	1	5	17	27	25	26	10	8	0	0	120	
1934	1	3	4	8	5	40	30	25	22	9	6	0	153	
1935	0	3	3	7	5	38	16	21	18	6	1	0	118	
1936	1	5	3	13	20	27	24	32	16	15	2	1	159	
1937	0	3	5	4	14	27	20	24	10	5	0	2	114	
1938	4	3	10	4	15	56	20	17	25	18	5	0	177	
1939	0	6	5	9	12	29	29	22	32	7	1	0	152	
1940	0	5	11	3	10	27	25	11	32	9	1	1	134	
1941	1	3	3	11	19	31	25	34	27	6	1	1	162	
1942	1	3	11	...	...	...	...	...	...	...	...	...	...	

RAINFALL: FORT HERTZ (PUTAO). HKAMTI LONG

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1928	...	...	...	...	...	...	31	29	44	14	Nil	Nil	161
1929	2	Nil	1	4	7	35	46	47	16	5	1	1	165
1930	1	2	5	8	3	20	33	48	26	6	3	Nil	164
1931	Nil	1	3	8	7	23	40	27	35	4	1	1	151
1932	1	1	2	3	15	35	31	44	28	5	1	1	166
1933	Nil	2	1	5	6	28	40	37	23	2	Nil	Nil	144
1934	1	2	1	7	4	31	29	39	28	8	2	Nil	152
1935	Nil	2	3	5	5	31	34	28	46	2	Nil	Nil	157
1936	1	4	2	1	16	26	30	43	19	7	1	1	152
1937	Nil	3	2	4	8	31	51	34	28	8	Nil	Nil	167
1938	1	1	6	7	15	10	29	29	22	11	5	Nil	172
1939	Nil	3	1	5	9	33	36	30	30	5	Nil	Nil	152
1940	1	Nil	5	2	8	25	38	42	24	9	Nil	1	156
1941	Nil	1	3	6	14	27	31	39	18	7	Nil	1	148

Altitude 1,600 ft.
Average for 14 years 157·6 in.
For decade 1932–41 156·6 in.
1931–40 156·9 in.

Max. rainfall 172 in 1938. }
Min. rainfall 144 in 1933. } 14 years.

fewer known endemics in Sino-Himalaya and hence in alpine Burma than one might expect, though no doubt many more remain to be discovered. The East Asiatic contribution is most prominent in the temperate zone. It suggests a strong E.-W. connection during the ice age. Such plants as *Stachyurus himalaicus*, *Rhododendron Simsii*, *Asteropyrum peltatum*, *Decaisnea Fargesii*, *Souleia vaginata*, *Tetracentron sinense*, *Mahonia lomariifolia*, *Saxifraga sarmentosa*, *Rubus corchorifolius* and *R. ampelinus*, *Photinia glabra*, *Eurya nitida* and *E. chinensis*, *Gordonia axilaris*, *Schima argentea*, with species of *Rodgersia*, *Podophyllum*, *Schizophragma*, *Actinidia* clearly indicate this connection. More remarkable still is the Chinese Coffin tree (*Taiwania cryptomerioides*) found in Formosa, south-western Yunnan and North Burma, a good example of discontinuous distribution—better called broken distribution since there is no physical barrier between the various localities unless it is between Formosa and the mainland. *Podocarpus macrophyllus*, on the other hand, has an unbroken distribution from Japan to North Burma as also has *Tripterygium Wilfordii*.

The land connections between North Burma and the East Asiatic region on the one hand and the East Himalayan region on the other are clear enough. Equally clear is the continuity between North Burma and the Malaysian region and Indonesia.

But what brought about such great movements of the floras, which is not just a gentle mingling, but a violent telescoping? How has it come about that Japanese plants are found in the Eastern Himalayas, North Burma plants in Indonesia and Malaysia? The almost complete absence of East Asiatic plants from peninsular India gives us a valuable clue to what may have happened. Peninsular India has no *Fagaceae*, *Betulaceae*, *Hamamelidaceae*, *Saxifragaceae*, *Schizandraceae* or *Coniferae* (except one *Podocarpus*). Many characteristic East Asiatic genera such as *Acer*, *Magnolia*, *Illicium*, *Deutzia*, *Philadelphus*, *Eriobotrya*, *Pyrus*, *Fraxinus*, *Ulmus*, *Trachycarpus*, *Livistona*, *Licuala*, *Gordonia* are absent; but all of them reached Malaysia, Indonesia or the Eastern Himalayas. We know that a similar flora reached China and New England from the far north as a result of and in fact during the Pliestocene ice age. If the western spread of eastern plants took place during the ice age, or after it, why did they not reach peninsular India at the same time? If they could reach south-east China, Indo-China and Malaysia not to mention the Eastern Himalayas, why not the hills of South India? A few—a very few Himalayan plants—did get through to peninsular India but only enough to emphasize their scarcity, e.g. *Rhododendron arboreum*.

There are two possible explanations: (1) either the plains were not yet solid land but consisted at best of brackish swamps, not unlike the Sunderbans today or (2) the Himalayan flora, driven into the plains by the advancing ice, perished ere it could cross them to reach the peninsula. In other words, the plains of India whether sea or land proved impassable; and of the plants driven south only those which followed the mountain arc of Burma-Malaya and the south-eastern strike of the ranges towards Indo-China, survived to return when conditions improved, leaving fragments of Himalayan flora scattered on all the mountains of Malaysia, e.g. *Primula imperialis* in Java.

It is improbable that the East Asiatic flora was already established in the Eastern Himalayas before the Pleistocene ice age. Even if it had been, it would have been largely destroyed or driven out by the ice wall which stretched from the Eastern Himalayas across North Burma and Assam to Western China; and these regions would have had to be restocked from surrounding areas during interglacial periods or after the ice age had passed. Moreover the Miocene-Pliocene flora of the Arctic, we know, was driven south and fanned out down the coast of China and down the Atlantic coast of North America. No doubt it reached the Eastern Himalayas and North Burma at the same time, via Indonesia, and perhaps across China, and failed to reach peninsular India only because it could not cross the hot swampy plains or the sea.

Thus on the eastern frontier mountains of Burma, Sino-Himalayan, Indo-Malaysian and East Asiatic floras mingled. During periods of intense glaciation, the mountain flora was pushed southwards—whatever was pushed northwards must have perished in the deserts of Central Asia. During interglacial periods, the southern flora crept back north. Communication between the Eastern Himalaya and Western China across North Burma was also open, before the deep river gorges were cut. This region was then a plateau. By the end of the ice age the cutting up of the Irrawaddy plateau, and the deeply dissected gorges of the Salween, Mekong and Yangtze rivers had to some extent interrupted this east-west movement, but the north-south movement was thereby facilitated. The close relationship between the Malaysian and North Burma floras has already been remarked; that between the Indonesian and North Burma floras is scarcely less close. Nor is it confined to the floras; it is also apparent in the faunas of these regions. Indeed the south-eastern route towards Hongkong, like the southern route towards Singapore, appears to be a modern migratory route for birds and has probably long been so.

Two striking examples within the writer's field experience may be quoted. The first example of *Harpactes wardi* (Ward's Trogon) was collected in the Seinghku valley in 1926. Several years later it was collected in Annam where it is not uncommon. Sooner or later it will no doubt be collected at some intermediate point in south-west Yunnan—unless indeed birds, like plants, can show discontinuous distribution. (In a sense of course, migratory birds do show a kind of discontinuous distribution).

Recently Dr. Harold Anthony of the American Museum of Natural History has identified a shrew not uncommon in the Hpimaw and Htawgaw hills as *Crocidura indochinensis*, a species described from Annam. Here again the distribution may be discontinuous.

Besides *Taiwania cryptomerioides*, there are other curious examples of discontinuous distribution of plants to the south-east, such as *Vernonia Vidalii* which. accord to Merrill, is known outside Luzon only from the 'Nmai valley (Vernay-Cutting Expedition 514 Ward). These are straws, but they point to possible lines of migration. Nor are they isolated examples. There are many birds common to North Burma, perhaps as summer residents only, and

Indonesia, just as there are many common to the Eastern Himalayas and Malaysia. The examples given are remarkable only because the species were collected at the extremities of their range and have still to be found at intermediate stations.

If the high land which stretches across south-east Asia from the Tsangpo bend in longitude 95°F. via North Burma and Yunnan to Indo-China is, as seems probable, one of the main migratory bird routes, we might expect to find many species of plants also with the same distribution. And so we do.

It is possible that in mid-Tertiary times the flora of Eastern Asia was more uniform than it is today. But differentiation of the flora into contrasting botanical regions must have proceeded some way before the Pleistocene glaciation set in.

Latest of all the floras to reach North Burma was the lowland forest flora, flowing up the hot moist valleys as rivers scoured them; already this subtropical Indo-Malaysian flora has reached almost to the sources of the Irrawaddy (lat. 28°). Until rivers had cut deep gorges in the plateau, no tropical flora could have lived here. The dampness of the climate helped it. At first the vegetation of the valleys resembled that of New Zealand or southern Japan in general appearance, with many tree-ferns and climbing plants. Even today the Tamai valley in lat. 28° at 4,000 feet altitude has a tropical appearance, where tree-ferns grow within sight of the snows, and luxuriant climbers and epiphytes flourish in the humid atmosphere, though the winter temperature drops to 40°F.

Finally we have to account for the alpine flora of North Burma. Here arises a special difficulty. In Europe the Arctic flora was driven south by the ice sheet and when the ice retreated the few survivors—much had perished—took refuge in the European Alps, or crept back north in the wake of the melting ice to its original home.

Only a single flora was involved, the Miocene-Pliocene circumpolar flora, and the distance it travelled before it was stopped by the transverse Alpine ranges and the Mediterranean Sea was at most 1,200 miles. Unable to cross these barriers, most of it perished. The same circumpolar flora which was driven south into Asia however had to travel no less than 3,000 miles to reach the Himalayas even by the direct route through Central Asia, which may have been partly desert. The Tian Shan and the Tibet plateau lay athwart its path; and finally the Himalayas being themselves glaciated (like the European Alps), no alpine flora could possibly lodge there except during an interglacial lull. In fact there is no evidence of any Arctic flora having reached the Himalayas by this route. A more probable route is that already described for the East Asiatic flora via the China coast and the Yunnan plateau, or via the Indo-Chinese ranges and Malaysia. But it does not seem probable that the circumpolar flora as such reached the Himalaya by this route, without undergoing great modification in the course of its long journey. For the Sino-Himalayan flora is more complex than the European-Alpine flora, although the two are obviously allied. Regarding the alpine flora of North Burma, a part of the Sino-Himalayan flora, let us set out the proved facts, the probable, but unproved facts and the reasonable assumptions, and see whither they lead us.

(*i*) Almost the whole of North Burma was during the Pleistocene period covered by an ice sheet. At this time therefore there could have been no alpine flora on the Irrawaddy plateau.

(*ii*) The modern North Burma alpine flora is part of the alpine flora which stretches from Kashmir to Western China and throughout Tibet—the Sino-Himalayan flora.

(*iii*) The present Sino-Himalayan flora has close Palæarctic affinities.

(*iv*) Before the Pleistocene glaciation the Irrawaddy plateau was covered with some sort of flora, just as the rest of Sino-Himalaya was covered with some sort of flora, whether alpine, subalpine or otherwise. There is no reason to suppose that the region, with the possible exception of Tibet, was a desert. The southern escarpment of the plateau at any rate must always have supported a rich flora except when it was actually under ice.

(*v*) It is probable that the pre-glacial Sino-Himalayan flora was as uniform over the whole mountainous area as the present one, or more so; it may have been poorer in species.

(*vi*) This pre-glacial flora can hardly have had much in common with the circumpolar flora which in Pliocene or at any rate in Miocene times was a moist warm temperate flora. Even though the two may have been in direct contact through north-west Europe or north-east Asia or both, there was no reason why they should mingle.

(*vii*) Before and during the ice age movement along the entire length of the Alpine-Himalayan system, from north-west to south-east and also north and south along the Burma-Malay arc was unhindered. These were two of the great migration routes in south-east Asia.

(*viii*) If both ends of the Sino-Himalayan region were in direct contact with the Holarctic region which stretched across the Eurasian continent, it would provide a possible route or routes by which the Holarctic flora could later reach North Burma. In the north-western Himalaya numerous alpines common to the Arctic regions, but so far not recorded from the Eastern Himalayas, occur. Yet the fact that a few species are common to the Arctic, and are found throughout the length of the Himalaya suggests this as one probable line of migration. For example *Thalictrum alpinum*, *Corydalis cashmeriana*, *Draba alpina*, *Saxifraga flagellaris* are common to North Burma, the Himalayan region and the Arctic regions.

(*ix*) An ice sheet covering northern Siberia fanning out southwards, might have driven the circumpolar flora southwards through Central Asia.

(*x*) Another possible route by which the circumpolar flora might have reached Sino-Himalaya is via the China coast and the highlands of South China, thence north-westwards across Indo-China and Yunnan. We know that the ice did drive the circumpolar flora southwards fanwise—it is the classic explanation for the striking resemblances between the flora of maritime China and Japan and the Atlantic States of North America. It seems probable that such trees as, *Taiwania*, *Gordonia*, *Rhodoleia*, several laurels, Magnolias, Rhododendrons, *Vernonia Vidalii* and *Hamamelidaceae* reached North Burma by this route. Some of the above might yet be found in the Eastern Himalayas or at least in northern Assam. Some alpines too may have followed this route.

(*xi*) Periods of maximum glaciation must always have kept the East Asiatic and Himalayan floras apart. It is obvious that no plants, East Asiatic or otherwise, could reach the Himalayas, itself a glaciated region, during an all out ice age. The Himalayan flora was being driven outwards. Any plants driven south-east got away, any plants driven into Central Asia perished in the desert just as much of the circumpolar Magnolia flora which was driven into Europe, perished on the shores of the Mediterranean or against the Alpine-Carpathian barrier. But some of the northern flora after being telescoped into the eastern Mediterranean flora might escape along the Himalayas and travel intermittently the full length of these mountains during interglacial periods.

Equally from another polar quadrant the escaping flora might have moved gradually across China, following the northern mountain folds to the eastern edge of the Tibet plateau.

(*xii*) The succession of glacial and interglacial periods was the principal means for the restocking of Sino-Himalaya, including North Burma, after the destruction of the original flora. During the early stages, whatever flora there was there, must have been driven out and much of it was overwhelmed. Since the last advance of the ice the flora has been steadily following up the retreat. Meanwhile a new flora had been driven across eastern Asia, coming from the north. The above are assumptions ; if they lack proof at least there is a certain amount of evidence for them, no fatal objection to their acceptance. In fact they are reasonable inferences. We have to account for the Palæarctic affinities of the North Burma alpine and subalpine flora and we infer that it was derived, like the North American and alpine European floras and in the same way mainly from the north. Most of the North Burma alpines are found in Western China or in the Eastern Himalayas, or in Tibet. Endemic alpines are few. The affinity is with the east rather than with the west, indicating that the flora has been largely derived from that direction.

This is well illustrated by the genus Rhododendron. About 130 species are recorded from Burma, the great majority of them from North Burma.

The table on p. 571 shows the distribution of 80 species which I have collected in North Burma :

This list of North Burma species is not complete, and the distribution of species is likely to be modified in the future with further exploration. But I believe it gives a fair general picture of the lay-out and hence a clue to how Rhododendrons came into North Burma during and after the glaciation.

Ths first thing to notice is the large proportion of endemics, 24 out of 80 or 30%. Only seven of these are alpines however.

Secondly, whereas North Burma shares 3 species with the Eastern Himalaya only (i.e. with the mountains to the west), it shares no less than 22 species with the mountains to the east alone. Even if the Assam-Tibet area to the north-west is included, it only adds 8 species to the three mentioned. If we add another 8 species,

NORTH BURMA SPECIES OF RHODODENDRON

Name of species	Endemic	Sikkim and E. Himalaya	Assam and S. E. Tibet	Yunnan	—
aemulorum	...	...	...	+	
agapetum	+	...	...	...	
apodectum	+	...	...	...	
arizelum	...	...	+	+	
asperulum	+	...	...	...	
Beanianum	+	...	...	...	
Beesianum	...	...	...	+	
bullatum	...	...	...	+	
butyricum	+	...	...	...	
calciphila	+	...	...	...	
calostrotum	+	...	...	...	
campylogynum	...	...	+	+	
cephalanthum	...	...	...	+	
cerasinum	...	...	+	...	
chamaetortum	+	...	...	...	
chryseum	...	...	...	+	
chrysolepis	...	...	+	...	
crassum	...	...	...	+	
crebreflorum	...	...	+	...	
crinigerum	...	...	...	+	
decorum	...	...	...	+	
Delavayi	...	...	...	+	
dendricola	+	...	...	...	
dendrocharis	+	...	...	...	
eclecteum	...	...	...	+	
eriogynum	+	...	...	...	
euchaites	...	...	+	+	
facetum	+	...	...	...	
fulgens	...	+	...	...	
Genestierianum	...	...	...	+	
habrotrichum	...	...	...	+	
hylaeum	...	...	...	+	
hypolepidotum	...	...	...	+	
imperator	+	...	...	...	
insculptum	+	...	...	...	
kasoense	...	...	+	...	
keleticum	+	...	...	...	
Kyawi	+	...	...	...	
leptothrium	...	...	+	+	
magnificum	...	+	...	...	
Martinianum	...	...	...	+	
megeratum	...	+	+	+	
megacalyx	...	...	+	+	
manipurense	...	...	+	...	
microphyton	...	...	...	+	
micromeres	...	...	+	+	
myrtilloides	+	...	...	...	
neriiflorum	...	+	...	+	
niphargum	...	...	+	+	
notatum	+	...	...	...	

NORTH BURMA SPECIES OF RHODODENDRON—(*Contd.*)

Name of species	Endemic	Sikkim and E. Himalaya	Assam and S. E. Tibet	Yunnan	—
pankimense	..	+	...	...	
praestans	...	...	...	+	
protistum	...	...	...	+	
pruniflorum	+	...	...	...	
pumilum	...	+	+	...	
repens	...	+	+	+	
rhaibocarpum	...	...	+	+	
riparium	...	...	+	...	
saluenense	...	...	...	+	
selense	...	...	...	+	
seinghkuense	+	...	...	...	
sidereum	...	+	+	+	
Simsii	...	...	...	+	
sino-grande	...	+	+	+	
sino-nuttallii	...	...	+	+	
Stuartianum	...	...	...	+	
stenaulum	...	...	+	+	
suaveolens	+	...	...	...	
Taggianum	+	...	...	...	
tanastylum	...	...	...	+	
tarorense	+	...	...	...	
telopeum	...	...	+	+	
tephropeplum	...	...	+	+	
timeteum	...	...	...	+	
trichocladum	...	...	+	+	
triflorum	...	+	+	...	
tsarongense	...	...	+	...	
vaccinioides	...	+	+	...	
vesiculiferum	+	...	...	...	
virgatum	...	+	+	...	
xanthostephanum (aureum).	...	...	+	+	

common to both the Eastern Himalaya and to the Assam-Tibet area, we still have only 19 species from the west as compared with 22 species from the east. But in that case we must add 13 species recorded from both China and Assam-Tibet, increasing the total of eastern species to 35, or almost 44% of the whole. The Assam-Tibet area in fact belongs as much to the eastern mountain region as to the western; it is the link between the two. For that reason it is perhaps curious that only three species are known to occur in all four areas, i.e., to go right across from the Eastern Himalaya to Yunnan via both Assam and North Burma; though this I attribute to lack of exploration—I suspect that more species do in fact cover the whole area. It is significant that one of the three—*R. repens*—is an alpine.

Apart from a general resemblance in its *Cruciferae*, *Papilionaceae*, *Caryophyllaceae*, *Rosaceae*, *Compositae*, *Umbelliferae* and in its Saxifrages, Anemonies, Primulas, Gentians, *Ranunculus*, *Polygonum* and a score more genera, what Arctic *species* of plants are there in North Burma today which are unknown elsewhere? Only *one* that I know of—*Cornus suaedica*, which I found on the Nam Tamai range at about 10,000 feet altitude in 1937. And since this plant is unknown from the Himalayas, it probably reached North Burma by way of north-east or possibly south-east China.

In the immense spaces and varied climates of Sino-Himalaya, many northern genera found new centres of development, e.g. *Rhododendron*, *Primula*, *Meconopsis* (all but one endemic) Berberis, Pedicularis, Cotoneaster; while other large genera of world wide, northern distribution such as *Lilium* and *Senecio* produced new independent genera (*Nomacharis* and *Notholirion*; *Cremanthodium* and Ligularia). But it is worth noting that *Campanula*, so prolic in the mountains of Europe, made no headway in Sino-Himalaya and is represented by few species. Other genera of *Campanulaceae* are fairly well represented. One point emerges clearly. Since the Palæarctic flora got as for as Australia where *Rhododendron Lochae* is an outlier there is nothing surprising in its having firmly established itself in Sino-Himalaya; if indeed the entire alpine flora of Sino-Himalaya is anything more than a modified and greatly enriched Palæarctic flora. There are a number of Sino-Himalayan endemics, but few of them are peculiar to Burma. One other point—the glaciation of South-East Asia roughly outlined the limits of the various floral regions now recognisable, by interposing a barrier of ice in the form of a vast arc between India and China and between India and Central Asia. It was not until the passing of the ice and the establishment of the Sino-Himalayan flora proper, that the present drainage came into being. Another result was to substitute a mainly north and south migration movement for the hitherto predominantly east and west migration movement along the Himalayan chain. An alpine flora, driven from the Eastern Himalayas by increasingly severe conditions, unless it escaped along the generally lower ranges to the south-east, had the choice of going north onto the Tibet plateau or south into the plains of Bengal—if indeed this was yet dry land and not swamp. Neither was an encouraging prospect. But the Burma-Malay arc and the mountains which strike south-east into Indo-China offered a line of escape. Possibly some of the preglacial flora also escaped by this route.

The most important fact which emerges however is that the flora of North Burma, being mainly Sino-Himalayan, is almost entirely a post-glacial flora. Even the Indo-Malayasian element in it is modern. With glaciers as far south at Htawgaw (lat. 26°) where there is unquestionable evidence of glaciation, it is hardly possible to imagine any considerable alpine flora surviving in North Burma during the height of the glacial age.

In Miocene-Pliocene times there were perhaps no greater barriers to free movement between different parts of South-East Asia than those of climate and altitude, so far as plants are concerned. Continental and maritime climates no doubt existed. But since an arm of the sea extended between peninsular India and the Himalayas (which together with the Tibetan plateau may have been lower), the continental climate would have been mitigated. Thus there may even then have been a slow interchange of flora between the China coast and Kashmir. The first onset of glacial conditions set the floras in swifter motion. Two results followed from the Sino-Himalayan glaciation.

(*i*) A violent telescoping of floras, whereby the circumpolar flora was pushed southwards into Europe, North America, and Siberia. It then fanned out in East Asia, down the China coast and probably along other routes. At the same time the Sino-Himalayan flora was telescoped into the Malaysian and Indonesian floras. (Any flora on the northern slopes of the Himalayas and in Tibet doubtless perished in Central Asia).

(*ii*) At the same time a great wall of ice stretched across Asia from Kashmir to Annam and the Central China plateau, cutting off all the interior of Asia from the peninsulas of India, Malaya and Indo-China.

During interglacial periods however this barrier would disappear and the crowded floras of the south would stretch out and flow back to fill the spaces uncovered by the retreating ice. In this way circumpolar plants, pushed down the China coast, might eventually turn north-westwards, towards the Himalayas, while the Malaysian flora also would move north through Burma.

If the Sino-Himalayan area experienced the same succession of glacial climaxes and inter-glacial periods which we can recognise in Europe, such movements would of course have taken place several times.

(*To be continued.*)

OCCURRENCE OF BIRDS IN MADURA DISTRICT.

BY

EDWARD G. NICHOLS.

PART II

(*Continued from Vol.* xliv, *No.* 3 (1944), p. 407).

Picus xanthopygaeus. Green Woodpecker. *Maran kotthi, Thachan kuruvi.*

4000′ to the top of the Palni Hills. (In other districts it is found down to 200′.)

Resident.

Uncommon, among thick trees. The call is a mild falsetto laugh.

Picus chlorolophus chlorigaster. Yellow-naped Woodpecker.

Sālim Ali observed it at Periyār Lake, 3000′, and Fairbank took a specimen at Periyūr, 4000′. (In other districts it occurs from the plains up to 6600′.)

Probably resident.

Dryobates mahrattensis mahrattensis. Pied Woodpecker.

Plains, and Fairbank found it up to 5000′ in the Lower Palni Hills.

Resident.

Rare on the plains, but Fairbank called it fairly common on the hills.

Dryobates hardwickii cinereigula. Pigmy Woodpecker.

Western hills from 2400′ up to Machūr, 4500′. (In other districts down to the low country.)

Resident.

Rare.

Micropternus brachyurus. Rufous Woodpecker.

Specimens of the race *jerdoni* have been taken on the Shevaroys and in Travancore.

Salim Ali and I have seen the species at Thēkadi, 3000′ and it is found up to 5200′ in the Palni Hills.

Resident.

Reported to be common on the High Wavy Mts.

Brachypternus benghalensis puncticollis. Golden-backed Woodpecker.

Specimens of the race *tehminae* have been taken in Travancore.

Plains, and up to 4700′ in the High Wavy Mts.

Resident.

Uncommon, but the only woodpecker regularly seen, on the plains. Common in the lower hills. Found in fairly open country as well as forest. The call is a high-pitched laugh, less emphatic and more tinny than the White-breasted Kingfisher's.

Chrysocolaptes guttacristatus chersonesus. White-naped Woodpecker.

Fairbank found it at all elevations on the Palni Hills. Prater's specimen must have been taken not at Madura itself but on the High Wavy Mountains.

Resident.

Seventy years ago Fairbank called it common. I should say it is uncommon today.

Hemicircus canente cordatus. Heart-spotted Woodpecker.

Recorded only at Periyār Lake on our western boundary, 3000.′ (In Travancore it is found from the low country up to 4500′.)

Probably resident.

Vivia innominata. Piculet.

Specimens from the Nilgiris and Travancore belong to the race *avunculorum*.

I have seen them in trees from 2400′ to 5500′ on the Palni Hills. (Elsewhere as low as 2000′.)

Resident.

Uncommon.

Iynx torquilla. Wryneck.

A specimen of the typical form has been obtained in Mysore.

I have seen only one bird in scrub jungle near Batlagundu, on December 10 and a friend reports one at Kodaikānal in November.

Winter visitor.

Thereiceryx zeylanicus zeylanicus. Ceylon Barbet. *Kukuruvān.*

I have records only between 1000′ and 2000′, and J. P. Cook secured one at about 2000′. A friend from Ceylon tells me he has seen them at Kodaikānal, 7000′. (In other districts it occurs up to 4000′.)

Resident.

Uncommon, in forests.

Thereiceryx viridis. Small Green Barbet.

Hills from top to bottom, but never on the plains.

Resident.

Abundant wherever there are trees. Ranks 8th on my Kodaikānal list.

Xantholaema haemacephala indica. Crimson-breasted Coppersmith. *Sinna kukuruvān.*

Plains, and as high as 4400′ in the hills. Fairbank was quite correct in his observation of this species in the lower hills.

Resident. One digging a nest-hole on September 3.

Common, frequenting fairly heavy trees. The *took* note is repeated deliberately, as fast as 108 per minute.

Xantholaema rubricapilla. Crimson-throated Coppersmith.

Specimens of the form *malabarica* have been taken on the Cardamom Hills.

Western hills from 2600′ to 4500′. (Also in the low country in Ceylon.)

Resident.

Rare, in forests.

Cuculus canorus. Asiatic Cuckoo. *Kuyil.*

The subspecies which breeds in the central Himalayas is called *telephonus*.

Plains. (Also on the hills in the Nīlgiris.)

Winter visitor. I have seen it only three seasons, from October 17 to December 13.

Rare, in trees in open country.

Cuculus micropterus. Indian Cuckoo.

The typical *micropterus* has been obtained in Travancore..

Plains. (To 5000′ in the hills in other districts.)

I have seen this species only twice, on October 28 and April 27. (Resident in nearby districts.)

Rare, in groves of trees.

Hierococcyx sparverioides. Large Hawk-Cuckoo.

Howard Campbell is the authority cited by Stuart Baker for the occurrence of this species in the Palni Hills. I have seen only one bird at 4000′ on June 18th, probably of this species. (From the plains up in other districts.)

Probably resident.

Hierococcyx varius. Common Hawk-Cuckoo.

Plains, and as high as 5400′ in the Palni Hills.

Resident in the hills, chiefly seen in winter on the plains.

Fairly common on the plains, common on the hills. Its 'brainfever' calls commence in March and last until October.

Clamator jacobinus jacobinus. Pied Cuckoo. *Kondai kuyil, Sāthaha pul.*

A specimen of *C. j. pica* has also been taken on the Nīlgiris.

Plains, and hills up to 4800.′ (In the Nilgiris up to 7000′.)

Resident.

Uncommon, preferring scrub jungle but wandering about much. The loud, mournful notes remind one of a shore-bird.

Clamator coromandus. Red-winged Cuckoo.

There is a mounted specimen in the American College, Madura, secured by Star & Sons, probably at Shōlavandān. (Up to 6000′ in other districts.)

Rare winter visitor. (October to March in Ceylon.)

Eudynamis scolopaceus scolopaceus. Koēl. *Kuyil.*

Plains, and up to 6900′ in the hills. (To 7000′ in the Nilgiris.)

Resident.

Uncommon, wandering about much, usually found in thick groves. The voice is somewhat sweeter than that of the Hawk-Cuckoo.

Rhopodytes viridirostris. Malkoha. *Pūlā poruki.*

On the plains, it extends out from the foot of the hills as far as 7 miles. In the Lower Palnis, it is found as high as 2000′. (Ascends as high as 4000′ in Mysore.)

Resident.

Fairly common in scrub jungle. I have heard a very mild, querulous croak.

Taccocua leschenaultii leschenaultii. Sirkeer Cuckoo.

1000′ to 3000′ on the western hills. (As high as 6000′ in the Nīlgiris.)

Resident.

Uncommon, found in thorny bushes on the lower slopes.

Centropus sinensis parroti. Southern Crow-Pheasant. *Sem bōtthu, Senpaham.*
Plains, and as high as 7000′ in the hills.
Resident. Seen mating on December 10.
Fairly common on the plains, common on the lower hills, occasional at the top. Found in groves of trees. The deep, resounding *hoo* is repeated 6 to 8 times.

Centropus bengalensis (bengalensis?) Lesser Crow-Pheasant.
Sālim Ali took a specimen at Kumili, 3000′. (Up to 5000′ in other districts.)

Psittacula krameri manillensis. Rose-ringed Paroquet. *Pachai kili.*
Plains and in cultivated places on the Upper Palnis up to 6000′.
Resident.
Common, ranking 10th in order of abundance in my notes. Flocks of 50 or more are found.

Psittacula cyanocephala cyanocephala. Blossom-headed Paroquet. *Sivapputhalai kili.*
Plains, and in the hills up to 5500′ according to Terry. (To 7000′ in the Nīlgiris.)
Resident.
Fairly common when grain and fruit are ripe. The notes are softer and sweeter than the Rose-ring's, and quite varied.

Psittacula columboides. Blue-winged Paroquet.
1400′ to 4500′ on the western hills. (In Travancore it ranges from the low country to 5000′.)
Resident.
Fairly common in tall trees in forests. The call is a high-pitched, soft and pleasant *queenk*, not as sweet as the Blossom-headed's.

Coryllis vernalis. Loriquet. *Kanni kili.*
From the base of the hills up to 4500′. (In the Nilgiris up to 6000′.)
Resident.
Common in the tree-tops in wooded sections.

Coracias benghalesnis indica. Southern Roller. *Panan kākai, Pāl kuruvi.*
Plains, and there are a few records in the western hills up to about 3500′ by Terry. (In the Shevaroys it has been recorded up to 4000′.)
Resident.
Common, frequenting exposed perches and palm trees in open country.

Merops orientalis. Common Bee-eater. *Panjuruttān.*
The typical race has been secured in Trichinopoly Dist. and Travancore.
Plains, and on open slopes of the Palni Hills up to 4900′. (In the Nilgiris it has been noted up to 7000′.)
Resident.
Common, sometimes as many as 50 in a flock.

Merops superciliosus javanicus. Blue-tailed Bee-eater.
Plains. Fairbank found the species as high as Periyūr, 4000′. (In Ceylon it reaches 5000′.)
Winter visitor, arriving August 10 one year, August 30 another, but more often in September. Last date, April 2. I also saw one at the north base of the Sirumalai on June 13, July 4.
Abundant, in flocks of hundreds on wires.

Merops leschenaulti. Chestnut-headed Bee-eater.
The subspecies *leschenaulti* has been taken in Salem District and Travancore.
Hills, from 750′ at the foot of Alahar Malai up to 6400′ near Kodaikānal.
Resident.
Fairly common on the open slopes. The notes are a little more musical than those of the other bee-eaters.

Bucia athertoni. Blue-bearded Bee-eater.

1500′ to 4000′ on the western hills. (Up to 5000′ in the Nīlgiris.)

Rare at the edge of forest. Resident.

Ceryle rudis. Pied Kingfisher. *Mīn kotthi.*

The race *leucomelanura* has been taken in Cuddapah District and Ceylon, while Travancore specimens belong to *travancoreensis.*

Plains, and up to 6600′ at Kodaikānal once.

Resident.

Fairly common where there is plenty of water. The call is a shrill, sharp, twittering cry.

Alcedo atthis. Common Kingfisher.

The subspecies *taprobana* has been taken in Travancore and at Palghat.

At all elevations.

Resident.

More common than the Pied, wherever there is water on the plains. In the hills it is uncommon.

Ramphalcyon capensis. Stork-billed Kingfisher.

The subspecies *gurial* has been taken in N. Kanara.

Plains, and Sālim Ali saw it as high as Periyār Lake, 3000′. (Up to 3500′ in other districts.)

Probably resident.

Rare, but Fairbank observed it twice at the foot of the Palni Hills years ago and I have two records near Periyakulam.

Halcyon smyrnensis. White-breasted Kingfisher.

The typical *smyrnensis* has been taken in Salem District, *fusca* in Travancore.

At all elevations.

Resident.

Common on the plains, uncommon in the hills. Often seen on the plains far from water.

Dichoceros bicornis. Great Hornbill. *Malai māngu.*

On the western hills, from the base up to 5500′. The former locality is noted in J. R. Henderson's list, and the latter is reported by Mr. J. H. Lawson, above Kūkāl Cave.

Resident. W. W. Wallace found a nest in the Varusha Nādu valley.

Uncommon, in the wildest forests only; perhaps most numerous on the High Wavy Mountains.

Tockus birostris. Common Hornbill. *Iru vāy kuruvi.*

Plains only. (In other districts the species ascends the hills to 3000′.)

Perhaps only a winter wanderer. Fairbank took a specimen near Palni in October 1876, and my only record is of a flock of 6 in roadside trees near Ayakudi on March 3.

Rare.

Tockus griseus. Malabar Grey Hornbill.

The typical form has been taken in Travancore.

At the base of the western hills, reported by Fairbank doubtfully, J. R. Henderson, and J. H. Lawson probably. (The species is found from 400′ to over 5000′ in Travancore.)

Probably resident.

S. K. Bunker and I saw one flock in forest 2400′.

Upupa epops. Hoopoe, *Kondai lātthi, Pulu kotthi.*

The resident subspecies, *ceylonensis,* has been obtained on Rāmēswaram, in Trichinopoly District, and Travancore. The European race, *epops,* has been taken in winter in N. Kanara, and probably also by Fairbank on the Palni Hills, but Fairbank did not send his specimen to Hume for identification, so this is not certain.

At all elevations where houses are found. In Kodaikānal it was unknown in Fairbank's day, 1877, but by 1883 Terry had noted it 'everywhere in small numbers'.

Resident.

Fairly common on the plains, common in Kodaikānal. I have timed the calls and counted as many as 19 in a minute.

Harpactes fasciatus malabaricus. Trogon. *Vandu kutthi.*

From 2500′ up to 5000′ on the western hills. (2000′ to 6000′ in other districts.)

Resident.

In dense forests, small flocks are seen in undergrowth. Rare.

Micropus melba bakeri. Alpine Swift. *Ulavāra kuruvi.*

At all elevations.

My records all fall between January 27 and September 10. This period probably includes the breeding season. In August Jerdon observed near Madura flocks apparently migrating eastward. (Biddulph saw the species on Rāmēswaram only from December to March and from August to October.)

Uncommon, sometimes solitary, sometimes as many as 20 together.

[It will be remembered that Biddulph (*Jour.*, xl, 247) recorded parties of 20 to 40 'seated on telegraph wires alongside the railway line'. To our enquiry the author has confirmed his statement since. Nevertheless sitting on telegraph wires is such an unheard of—and seemingly impossible—thing for a true swift to do, that it does not seem beyond the bounds of possibility some error in identification may have crept in. To that extent this particular record needs to be taken with reserve. But the Alpine Swift may, of course, occur on Rāmēswaram Island notwithstanding.—Eds.]

Micropus affinis. House Swift.

The typical *affinis* has been taken in South Arcot District.

At all elevations.

Resident on the plains.

Locally common on the plains, especially in old temples and the Madura palace, in flocks of about 200 or more. Occasional large flocks over the hills.

Cypsiurus parvus. Palm Swift.

The subspecies *batassiensis* has been taken in Salem District and Travancore.

Plains, and up to 2000′ on the Lower Palni Hills.

Resident.

Very common, ranking 6th in abundance among our plains-birds. Seldom seen out of sight of palmyra palms. The call is thin and shrill, a cheerful staccato series of notes.

Chætura gigantea. Brown-throated Spinetail Swift.

Specimens of the race *indica* have been taken in Travancore.

Plains, and up to 5600′ in the Palni Hills.

All my records fall between December 2 and July 31, except October 11.

Fairly common on the plains, especially near the foot of the hills. It gives a loud, shrill twittering, rather sweet in tone.

Indicapus sylvaticus. White-rumped Spinetail Swift.

I have seen the species only once at 7200′ near Pillar Rocks. (In other districts it is found in jungle as low as 2000′.)

Collocalia fuciphaga unicolor. Swiftlet.

At all elevations.

Resident in the hills.

Very common in the hills, ranking 4th among Kodaikānal birds. I have seen the species in only a few places on the plains, usually near the foot of the hills, but once at Shōlavandān.

Hemiprocne coronata. Crested Swift.

From 1000′ to 7000′ on the western hills and once at Madura.

Resident. My records fall between February 1 and October 2.

Fairly common among thin trees on the drier slopes of the lower hills, as many as 15 in a flock.

Caprimulgus macrourus. Long-tailed Nightjar. *Pāthuhai kuruvi, Pathungi.*

The subspecies *atripennis* has been taken in Travancore.

Plains, and up to 3000′ in the hills. (In Travancore 3500′.)

Resident.

Mrs. Cantlay reports it to be common on the High Wavy Mountains. I have only a few records, mostly near the base of the hills.

Caprimulgus indicus indicus. Jungle Nightjar.

From 5000′ to 7000′ on the western hills. (In other districts it is found down to the low country.)

Resident.

Terry called it common on open downs near sholas. I have only a few records.

Caprimulgus asiaticus asiaticus. Little Nightjar.

Plains, and up to 1100′ at the base of the hills. (Up to 4000′ in Ceylon.)

Resident.

Fairly common in scrub jungle, barren fields, boulder-strewn hillsides.

Tyto alba stertens. Barn Owl. *Kūhai.*

Plains, and up to about 2000′ on the lower slopes of the Palni Hills. Dr. T. C. Jerdon caught one alive when it flew into his room at Madura.

Resident.

Fairly common, judging from the frequency of sucking or grating calls at night.

Tyto longimembris. Grass Owl.

The typical form has been taken on the Nīlgiris.

The only record is Terry's sight observation at Pallangi, 5500′, on the Palni Hills. (In other districts it occurs on the plains also.)

Asio flammeus. Short-eared Owl.

The typical *flammeus* has been taken on the Nīlgiris and in Travancore.

Hume & Dewar both stated that this species had been procured on the Palni Hills. (In other districts the range is from the plains up to 7000′.)

Winter visitor. (The season in Ceylon is from November to February.)

Rare.

Strix indranee. Brown Wood Owl.

Specimens of the race *indranee* have been taken on the Shevaroy and Nīlgiri Hills.

Plains, and up to 1100′ in the Varusha Nādu valley. (At all elevations in other districts.)

Resident.

I have one sure sight record on July 30, others doubtful.

Strix ocellata. Mottled Owl.

Plains, where I have heard a metallic note from two large owls at Batlagundu in January. Large owls along the roads at night may be this species. (Occurs as high as 2800′ in Mysore.)

Probably resident.

Ketupa zeylonensis. Fish Owl.

Fairbank's specimen was probably *leschenaulti,* which has been surely taken in Salem District and Cochin State.

At Dindigul, I think I have heard it once, at Kodaikānal several times. (At all elevations in other districts.)

Resident.

Rare.

Bubo bubo bengalensis. Great Horned Owl.

Plains. (Ascends the Nīlgiri Hills rarely.)

Resident.

Uncommon, on the small rocky hills that rise out of the plains, and at the base of the larger hills.

Bubo nipalensis. Forest Owl.

The typical *nipalensis* has been taken in Salem Dist.

One record, at 1100′ in the Varusha Nādu valley on a cloudy afternoon. (In the Nīlgiris it occurs up to 7000′.)

Probably resident.

Otus bakkamoena. Collared Scops Owl. *Ānthai.*

The typical *bakkamoena* has been taken in Travancore.

Plains, and in the lower Palni Hills as high as 3400′. (To 4000′ in the Nīlgiris.)

Resident.

Fairly common in shrubbery near houses in places. I have seen only one by day.

Athene brama brama. Spotted Owlet.

Plains. (As high as 3000′ in Mysore.)

Resident.

Common everywhere, replacing the Drongos as soon as dusk sets in.

Glaucidium radiatum. Jungle Owlet.

The Travancore race is called *malabaricum.*

I have seen only one in daylight, on the slopes of the Palni Hills at 2000′ on June 22. (In Travancore this is the common owlet from sea-level up to 5000′.)

Resident, probably.

Sarcogyps calvus. Black Vuture. *Kaluhu,*

Plains, and at all elevations on the hills.

Resident. Howard Campbell records its breeding at Kodaikānal.

Uncommon. I have seen a few on the plains in winter, and more in the hills.

Gyps fulvus. Griffon Vulture.

The race *fulvescens* has been obtained in N. Kanara.

Sālim Ali's sight record at Kumili, 3000′, on February 28, is the only record for South India. [Probably Long-billed Vulture.—Eds.]

Gyps indicus. Long-billed Vulture.

The typical *indicus* has been obtained at Pondicherry.

Plains, and hills to 7700′ near Kodaikānal.

Probably resident.

I have only one record on the plains, a few more in the hills.

Pseudogyps bengalensis. White-backed Vulture.

At all elevations.

Resident.

Fairly common on the hills, rather less so on the plains. Sometimes 10 or more together near a town.

Neophron percnopterus. White Vulture. *Manjal thirudi.*

The type locality of the race *ginginianus* is Gingee, South Arcot Dist.

At all elevations.

Resident. A nest with half-grown young on July 30.

Common on the plains, less so on the hills. Frequently seen around towns.

Falco peregrinus. Peregrine Falcon. *Vallūru, Irāsāli.*

Specimens of the resident *peregrinator* and of the winter visitor *calidus* have been taken at Madras and in Travancore.

Plains and up to 4900′. At any altitude in other districts.)

Perhaps only a winter visitor. My records, some uncertain, extend from September 3 to March 29.

Rare.

Falco jugger. Laggar Falcon.

Plains. (In other districts up to perhaps 3000′.)

My records extend from April to August, but all of them are vague. (Biddulph's observations on Rāmēswaram Island run from June to November.)

Uncommon.

Falco chiquera. Merlin Falcon.

The typical *chiquera* has been taken near Bombay.

Plains.

Winter visitor in October and March only. (Breeds in Tinnevelly Dist.)

Erythropus amurensis. Red-legged Falcon.

I saw one on March 9 at Dindigul. (Jerdon found the species in the Nīlgiri Hills.)

Winter visitor as far south as Ceylon. (September to April is the period of stay farther north.)

Falco tinnunculus. Kestrel.

The resident race, *objurgatus,* has been taken in Travancore and on Rāmēswaram. The European race, *tinnunculus,* has been taken in winter in Salem, Travancore, and Ceylon. The Chinese race, *interstinctus,* has also been taken in winter in Coimbatore District and Travancore.

At all elevations. I have seen a nest at 8000′ in the Palni Hills. (On the Nīlgiris it breeds as low as 4000′.)

On the plains, my records extend from November 6 to April 14. (On Rāmēswaram, Biddulph found the arrival to be in October.)

Fairly common. The call is a screaming *klee* repeated rapidly a dozen times or more.

Aquila rapax. Tawny Eagle. *Irāsāli, Punjey parunthu.*

The subspecies is *vindhiana* in the case of a Madras specimen.

Single birds seen on December 2 at the foot of the hills near Batlagundu and on March 20 at Kodaikānal probably belonged to this species. Previously recorded only as far south as Madras, as a resident.

Aquila clanga. Greater Spotted Eagle.

Plains.

Winter visitor, on July 26 and from November 16 to April 12.

Uncommon, in wet fields, where it stands around or flies slowly low over the fields. There is a good specimen of this species in the American College, locally obtained.

Hieraëtus fasciatus. Bonelli's Eagle. *Parunthu.*

The typical *fasciatus* has been taken in Hyderabad State.

At all elevations on the Palni Hills. (On plains in Tinnevelly Dist.)

Probably a resident.

Uncommon, often perching on trees.

Hieraëtus pennatus. Booted Eagle.

I have two records on the plains, and one at Kodaikānal, 6900′.

Winter visitor, December 13 to March 20. (Arrives Oct. 17 in other districts.)

Rare.

Lophotriorchis kienerii. Rufous-bellied Hawk-Eagle.

Travancore specimens probably belong to the typical race.

From 3000′ at Thēkadi up to 7000′ at Kodaikānal, where S. K. Bunker has seen it. (In Travancore it occurs down to 200′.)

Resident.

Rare.

Ictinaëtus malayensis. Black Eagle.

The race found in Travancore is probably *perniger.*

From 1500′ to 8000′ on the western hills. (In Travancore it is also found as low as 500′.)

Resident.

Fairly common, over forests and open slopes.

Spizaëtus cirrhatus. Crested Hawk-Eagle. *Kondaiyan.*

The typical *cirrhatus* has been taken in Travancore.

4500′ to 7000′ on the Palni Hills. (Occurs also in the low country of Travancore.)

Probably resident.

Rare; have seen only 4.

Nisaëtus nipalensis. Feather-toed Eagle.

Specimens from Travancore belong to the Ceylon race, *kelaarti.*

I have only 4 probable records in the Palni Hills from 3000′ to 7100′. (In Travancore it occurs as low as 1000′.)

Circaëtus gallicus or ferox. Short-toed Eagle. *Onān kutthi*, *Pāmbu parunthu.*

Plains, lower hills, and once at Kodaikānal, 7000′.

Resident.

Uncommon, most often seen near the base of the hills.

Haematornis cheela. Serpent Eagle.

Specimens of *melanotis* have been taken in Travancore and Mysore.

Plains at Dindigul once, and on the Palni Hills as high as 7500′.

Resident.

Fairly common.

Butastur teesa. White-eyed Buzzard-Eagle. *Parunthu.*

Two sight records on the plains, Jan. 16 & Feb. 12. (Up to 2800′ in other districts where it is resident.)

Ichthyophaga ichthyaetus. Fishing Eagle. *Ālā.*

Stuart Baker says that Travancore specimens may be classed with the typical *ichthyaëta.*

Only observed at Periyār Lake, 3000′. (Occurs in the low country also in Travancore.)

Rare, resident.

Haliastur indus. Brahminy Kite. *Sembarunthu*, *Garuda patchi.*

Specimens from Pondicherry and Trivandrum belong to the typical *indus.*

Plains, and up to 7700′ in the hills.

Resident.

Common, being 9th in order of abundance among our plains-birds. Almost always found in sight of water.

Milvus migrans. Common Kite. *Karum parunthu.*

A specimen from the Shevaroy Hills belongs to the race *govinda.*

Plains, and in the hills at all elevations.

Resident.

Ranks 7th among plains-birds in my records. Also common in the hills. Flocks of about 40 gather when there is a plentiful supply of food such as termites.

Elanus coeruleus. Black-winged Kite. *Naraiyān parunthu.*

Sālim Ali collected one of the race *vociferus* on the Cardamom Hills, and the type-locality is 'Coromandel coast'.

Plains, and as high as 7500′ in the western hills.

Probably resident in the hills.

Rare.

Circus macrourus. Pale Harrier. *Pūnai parunthu.*

Plains. In the hills up to 7000′ E. L. Bradby has seen some.

Winter visitor, from Oct. 21 to March 24. Brown harriers, species not known, have been seen from October 3 to April 15. (The arrival date of the Pale Harrier is in September at Coimbatore, and a few stay all year in Ceylon.)

Common on the plains, less so in the hills.

Circus pygargus. Montague's Harrier.

Plains. (Also in the hills in other districts.)

Winter visitor, which I have definitely noted from November 7 until April 1.

Probably fairly common. There is a specimen, I think, in the American College, Madura.

Cirucs melanoleucus. Pied Harrier.

Plains, and up 6900′ at Kodaikānal.

Winter visitor, from November 28 to April 12. (April 18 is the departure date in Travancore.)

Fairly common.

Circus aeruginosus. Marsh Harrier.

The typical race has been taken in Travancore.

Plains. (It ascends the Nīlgiris to 7000′.)

Winter visitor, September 24 to April 22. (On Rāmēswaram it stays as late as June.)

Fairly common; more confined to water-filled fields than the other harriers are.

Astur badius badius. Shikra Hawk. *Kīchān vallūru.*

Sálim Ali's specimens from Kumili are assigned to the Ceylon race *badius*, but the Indian *dussumieri* occurs on the Eastern Ghats and in Mysore.

Plains, and in the hills as high as 7000′.

Resident.

Fairly common on the plains, in light jungle or trees near houses. I have seen one trying to catch bats at dusk. The call is a sharp double whistle, *kee, keeoo,* repeated tiresomely.

Accipiter nisus. Asiatic Hawk. *Ōnān adiki vallūru.*

Travancore specimens belong to the race *nisosimilis.*

Plains. (Up to 7000′ in other districts.)

Winter visitor, September 9 to January 17. (Stays at Coimbatore until March.)

Rare.

Pernis ptilorhynchus. Honey Buzzard. *Thēn parunthu.*

Specimens from the Nīlgiris belong to the subspecies *ruficollis.*

The species has been seen only by Sálim Ali at Periyār Lake, on our western border, 3000′. (Found from the plains up to 7000′ in forests in other districts.)

Baza jerdoni. Brown Baza. *Kāttu parunthu.*

The subspecies *ceylonensis* has been found in Travancore.

Palni Hills; my 2 records were at 5000′ and 6900′. (Found also lower in the Wynaad.)

Probably resident. May 11 & June 15 are my records.

(*To be continued*)

MISCELLANEOUS NOTES.

I.—A BLACK JUNGLE CAT FROM KARACHI AND THE PANTHER OF SIND.

The interesting account by Mr. K. R. Eates of the occurrence of a black Panther near Karachi, published in the *Journal* Dec. 1943, pp. 291-292, reminds me of the equally interesting and equally unexpected occurrence many years ago of a black, silver-tipped Jungle Cat at the same locality. Its skin, without further particulars, was sent by Mr. W. S. Millard, at that time Secretary of the Society, to the British Museum (Natural History) and I described it in my *Mammals of British India*, 1, p. 300, 1939. Very similar specimens of this beautiful variety, recalling a 'silver-fox', were shot by St. G. Burke in the United Provinces.

May I remind some of your readers that the panthers of Sind or at all events of the Kirthar Range are of particular interest and comparatively very little known to zoologists. On the evidence of a single skin given to him by H. E. Watson, Blanford pointed out in 1888 that this panther can be distinguished at a glance from the ordinary Indian and Ceylonese panthers. This skin is in the British Museum, but the only other skin of this race in the national collection is one from Waziristan presented by Major D. G. Lowndes. A description of this race may be found on p. 233 of my volume cited above. The value that sportsmen attach to such handsome trophies as panther skins, everyone understands; but on behalf of the British Museum I should like to make an appeal for either skins or skulls, preferably both, of this animal if they are available; and I may add that damaged or 'mangry' skins not worth making into rugs or women's cloaks are just as interesting to the zoologist as perfect specimens.

Zoological Department, R. I. POCOCK.
British Museum (Natural History),
February 29, 1944.

II.—JACKALS ATTACKING DEER IN CEYLON.

The jackals of Ceylon appear to be somewhat larger than those of S. India.

I have recently seen a remarkable cine picture of jackals pulling down and killing an adult chital in a pool in Ceylon; their tactics and methods being exactly the same as those of the Indian Wild Dogs.

R. C. MORRIS,
Lt.-Col.

III.—THE EASTERN RANGE OF THE HIMALAYAN BROWN BEAR (*URSUS ARCTOS ISABELLINUS*).

In the second volume of the *Mammals of British India*, p. 173, 1941, I stated that the range of this bear in the Himalayas was from 'the Valley of Chitral in the west to the basin of the Bhagirathi in Tehri Garhwal in the east and possibly to Nepal'; and I added a footnote suggesting that Horsfield's original specimen, recorded from the mountains of Nepal, was perhaps a traded skin from Tehri Garhwal or Kulu. The doubt thus expressed regarding its natural occurrence in Nepal was due to my being unacquainted at that time with any record of the bear having been shot or seen in that country. But Mr. N. B. Kinnear has recently drawn my attention to an account by T. W. Webber in *The Forests of Upper India,* pp. 95-96, 1902, which runs as follows:—'Our light camp was pitched on sloping ground in a considerable valley in Nepal, east of Kali, on the south bank of a rushing torrent which drained the extensive slopes of the lofty peak of Api . . . . At dusk we searched the hillside with binoculars and sighted some burrhel grazing, also a big brown bear. The black bear is usually found in *Kumaon*, and the brown in *Kashmir*; but a few of the latter exist in these valleys'. Since the Kali river is the boundary between *Kumaon* and *Nepal,* the occurrence of this bear at all events in the extreme west of the latter country is thus established and there is no longer any justification for doubting the accuracy of Horsfield's statement.

Zoological Department   R. I. POCOCK.
British Museum (Natural History),
March 10, 1944.

IV.—BEAR HUNTING ON THE WULAR LAKE.

As I was writing a note after an early breakfast a shikara (punt) arrived at my houseboat with an excited crew. I was invited to join a bear hunt on the waters of the Wular Lake. A solitary shikara half a mile away was following a black object in the water heading for the opposite shore, some 3 miles off. A man in the bows took occasional shots at the bear's head with a long crooked pole, which soon broke to bits. I refused to join the hunt, not being desirous of killing black bears in any circumstances much less without a licence and the poor creature defenceless. The deputation loaded its boat with as many big stones as it would safely carry and rejoined the chase closely followed by another manned by my cook, waiter and sweeper. While the bear was stoned from one boat, the cook in the other kept ducking him with a long punt pole. At this stage the bear began a series of roars that kept all craft at a distance, but the cook braver than the rest resumed his method of attack and literally dozens of boats joined in including a punt gunner in his craft with its long matchlock gun. The final killing was due to a combination of drowning and blows on the head from an axe. The bear was hauled ashore and skinned, the local forest guard insisting on taking the pelt and head to the Forest Officer as evidence of a flagrant breach of the Game Laws. My retriever daily eats bear steaks for his evening meal and seems to like them. The bear had come into a village on the shore of the lake and on being chased by dogs, took to the water. A similar killing took place further along the shore 10 days previously. It is said that this year jungle fruits are very poor and bears are hard put to get enough to eat. This one was in fine condition but not fat. His stomach contained walnut shells, honeycomb, a wasp's nest, some bees and wasps, grubs and a good many pieces of bone.

SRINAGAR, KASHMIR. G. DE LA P. BERESFORD,
December 30, 1943. *Major General.*

V.—BREEDING SEASON OF THE INDIAN SAMBAR.

Throughout the great mass of the Central part of the Indian Peninsula the rut takes place in the end of November or early in December.

With an animal so widely distributed as the Sambar, living under diverse conditions, one would expect departures from this normality, but not anything, so diverse, as that reported by Mr. Simon in his letter of January 21, 1943 (*Journ. B. N. H. S.*, Vol. xliv, No. 1, p. 118).

From that letter one gathers, that the antlers are shed in May, and breeding takes place in late June, and early July: this means that the rut takes place while the stag's horns are still in full velvet. So far as I am aware, this has never occurred in the case of any other deer, anywhere. Apart from the physical condition of the stag at the time, it is a complete negation of one of the main *raison d'etres* of the growth of the horn.

It is notorious that one of the first effects of captivity in a wild animal, is a disarrangement of the sex life, and it is probable that the extraordinary facts, reported by Mr. Simon are merely evidence of this disturbance having occurred, once again.

ELGIN, A. A. DUNBAR BRANDER.
SCOTLAND.
November 16, 1943.

VI.—THE LARGER DEER OF INDIA: A CORRECTION.

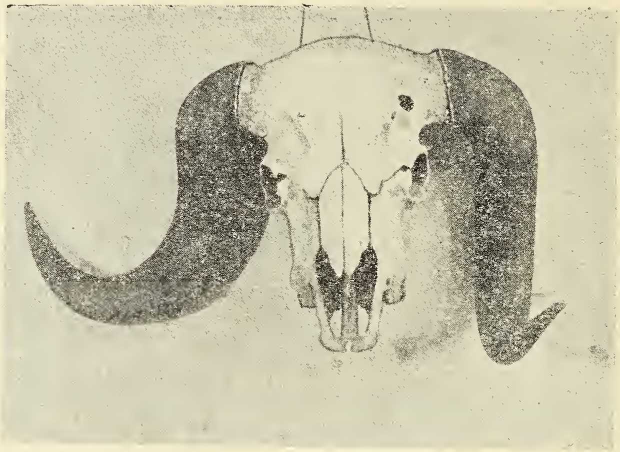
In my paper on the Chital and Hog-Deer published in the issue of this *Journal*, December 1943, there is a misleading error in the explanation of the text figure on p. 170. Fig. D in reality represents the incisiform teeth of a Sambar and C those of a Chital, not the other way about as stated. The very large median and small lateral teeth are of course characteristic of the Chital and Hog-Deer, not of the Sambar and other large deer previously described.

ZOOLOGICAL DEPARTMENT, R. I. POCOCK.
BRITISH MUSEUM (NATURAL HISTORY).
February 29, 1944.

VII.—MALFORMED HORNS OF THE GAUR (*BIBOS GAURUS*).

(*With a photo*).

We enclose a photograph of a 'Malformed' bison skull, a most interesting specimen, shot by H. H. The Maharaja of Mysore



Malformed horns of Gaur (*Bibos gaurus*).

near Hanakere in the Biligirirangan Hills, Mysore. We feel sure it will interest you and some of your readers.

MYSORE,
January 24, 1944.

VAN INGEN & VAN INGEN.

VIII.—OBSERVATIONS ON THE ELEPHANT AND OTHER MAMMALS IN THE ANAMALAI HILLS OF COCHIN.

These notes were made in the northern area of the Anamalai Hills, at an altitude of between fifteen hundred and two to three thousand feet, during a month spent studying the fauna between February 12th and March 10th, 1944.

I. The Indian Elephant (*Elephas maximus indicus*): I have three notes worthy of record. Taking them chronologically:

February 14th: I was watching, from the opposite slope of a narrow river valley, a herd of twenty-five to thirty elephants moving through a bamboo thicket. They stopped occasionally to feed, but were definitely on the move with loud cracking and snapping of bamboos. One of the local forest guards with me drew my attention to a full-grown bull which was lagging behind the remainder and pushing his way about in a rather dense thicket, giving us an occasional glimpse of him. Presently he appeared at the lower edge of the thicket, just above the river-bed, where he stood facing us, keeping quite still, but obviously on the alert.

A few moments later came a sudden crash, as another elephant, up to now hidden, blundered out of the same thicket, and went down into the dry bed of the river, perhaps fifty yards from the tusker, and out of his sight. He did not follow, but showed definite interest; soon afterwards he disappeared silently a short way into the bamboos, while the second animal remained motionless in the river bed. After two or three minutes, it climbed up the bank on our side of the river, and into full view, to reveal itself as a cow. She moved very silently along the bank, in the opposite direction to the herd, through a thin growth of bamboo, as if on 'tip-toe,' and stopped after some forty yards. The tusker meanwhile seemed to be making cautiously for her previous position in the stream bed. Unfortunately darkness was falling, and further observation was not possible.

The whole episode savoured of a game of hide-and-seek, and was, I assume, a phase of the courtship.

It is worth noting that there was at least one other tusker with the herd, who showed no interest, but moved on with the rest.

March 5th: Going out late in the afternoon after wild pig, I heard much crashing and rampaging in the undergrowth, not far from the forest track; I approached with my shikari as near as I dared; almost at once a big tusker reared up on his hind legs above the bamboo, and lunged forwards—followed by a crash as another bull, at which it was evidently aiming, lumbered off out of sight. The first bull did not follow it, but remained still, and the incident seemed over.

An hour later I was returning along the same path, and came on him moving about in much the same area as before; I sat down to watch, and suddenly this bull, up to now comparatively quiet, broke cover, and came past at full gallop, back arched and all his 'hackles' up—a gigantic and terrifying spectacle—to hurl himself into the thicket where the second animal had disappeared some time before. Nothing further transpired, and the other had evidently moved further on.

It was getting late, and I was unable to stop longer: but some way further down the path, I came on the second beast who had slipped well away to one side, and was standing motionless among the undergrowth.

The Kadar tribesmen of these hills and the forest guards inform me that running fights between bull elephants are quite frequent; and they maintain that it is the general rule for a tusker sooner or later to develop a feud against another. These feuds are said to be kept up intermittently over months or even years, and with ever-growing intensity, until the climax is reached in a battle royal, lasting several days, and invariably ending in the death of one or even both combatants. The final stages are said to be extremely noisy, and the tribesmen follow up at a safe distance to wait for the ivory of the vanquished.

I was told that such fights are particularly common during the two or three months immediately preceding the rains.

March 7th: I had come unexpectedly on a solitary bull, and beat a rapid retreat to a safe distance. He turned off the forest track, and after browsing a little, vanished into the forest. I was on the point of continuing on, when another elephant appeared round a bend in the path; this time a *calf*; it is naturally unheard of for a calf to be on its own, or to lead the way at any time. But very close behind it, there came into view the head and shoulders of a big cow; the two of them advanced down the path, the calf leading all the while, and both moving with extreme, exaggerated slowness. From my cover, eighty yards distant I could only wonder what so strange a reversal of normal habit might mean, until, as the line of the track brought them into side view, the mystery explained itself; for, hidden, almost invisible beneath the body of the mother was a second and minute calf, perhaps born only few hours previously, and which I judged to be week old at the most. As far as I could see it suckled continuously.

The pitiable reluctance of the larger calf—a picture of sulky bewilderment—to lead the way instead of trotting safely at its mother's side was comical to watch. It tried again and again to turn back, only to be countered every time by a swing forward of its mother's head and trunk. She kept up a ceaseless rumbling-grumbling, which I took to be a warning to her larger offspring to keep its place in front. Her skill and patience in controlling simultaneously each of her two offspring was quite remarkable. She moved at a shuffling walk, infinitely slow, stopping at frequent intervals, adjusting her every movement to keep step with the faltering pace of her newly-born calf. She as successfully kept the older one at 'trunk's length' in front, goading it forwards away from its normal position, so preventing any risk of interference with its diminutive brother or sister.

After some minutes she guided the party off the track, and into a stretch of light jungle, where I did not care to follow her.

Size is notoriously difficult to estimate in the field, but the larger calf appeared to be about four and a half feet at the shoulder or rather less; local opinion put its age at about two years. I do not know at what intervals elephants are known to breed, but in this instance, allowing for the recognised gestation period of 641 days, and assuming the age of the larger calf as correctly estimated, it seems that the two calves must have followed each other in immediate succession, the mother being possibly in breeding condition very soon after the first calf was born. It is curious that the customary female helper or 'nurse-maid' which is known always to assist with a calf, should have been absent, but I think it likely, especially in view of the very slow movements of the small calf, and the obvious bewilderment of the larger, that the smaller one was not more than a few hours old, and the 'helper' had not yet started on her duties.

I questioned the Kadar tribesmen and the forest guards concerning the breeding season; they stated quite definitely that they see small calves in every month of the year, and did not believe the 'Āna' to have any fixed breeding season.

The brief glimpse of courtship, the pugnacity of the bulls, and the additional fact that there were large bulls with every herd I saw, indicate February and March—the two months preceding the rains—as a time of breeding activity. On the other hand, the newly-born calf I saw must have started existence about June 1942, in the height of the rainy season.

II. Of the larger Game Animals, it is satisfactory to record that Gaur (*Bos bibos gaurus*), Tahr (*Hemitragus hylocrius*), Sambar (*Rusa unicolor*), *Chital* (*Axis axis*) and Mutjac (*Muntiacus muntjak*) all seem to be maintaining their numbers well in the area. I found Chital particularly numerous, and they are said to have increased somewhat during the past few years. I saw a number of good stages.

The Kadar tribe have a definite Taboo against eating either Sambar or Bison, but will take all other animals including the Langur Monkey. I watched four to five herds of Bisson all of which included large bulls, and I only saw one solitary bull. The strange wailing, piping note, usually regarded as the breeding call of the bull, was much in evidence. I came on one small calf, possibly two to three months old.

The Tahr or 'Nilgiri Ibex' seems to be little disturbed; I saw one herd of about twenty.

Chevrotain or Mouse Deer (*Moschiola meminna*) were likewise plentiful. I stumbled on one in a clump of Bamboo during the heat of the day, it bounded out and stopped in open ground. I kept perfectly still, and the little creature, though not more than ten yards distant and in full view, seemed quite unable to locate me, turning its head this way and that as if suspicious but puzzled.

I accordingly made a slight movement of my hand, of which it took no notice. Nor could I get it to respond at all to any movement, even when looking straight in my direction. To the smallest noise however it was most sensitive, instantly turning in the direction whence it came. These observations suggest that the chevrotain is extremely short-sighted, or even blind by day.

The protective colouration of this charming little deer is quite perfect. I heard a slight rustle one afternoon from beneath some *Lantana* bushes, and it took me some minutes to make out a mouse deer, crouched not five feet away, and this even though the ground was almost bare.

They are occasionally caught and tamed by the Kadars who say that they become very docile and follow their master within a few days of capture.

Tiger seem reasonably common in the hills, but black panther are very scarce, although common some years ago.

Of the three monkeys found in the Anamalais, the Nilgiri Langur (*Kasi Johnii*) is abundant, but the forest Officer informed me that they have shown some decrease during the past two or three years, possibly from an epidemic. A limited number are shot, mainly for the supposed medicinal value of the liver; they fetch a price of fifteen rupees when sent down to the plains for this purpose.

The handsome Lion-faced Macaque (*Macaca silenus*) is scarce. I found it twice, once a male in loose association with a party of Langurs, and also a family party of four or five feeding in a *Ficus* tree, oddly enough in company with the Great Indian Hornbill (*Dichoceros bicornis*).

I was intrigued to come on a party of the small Bonnet Macaque (*Macaca radiata*) bathing in a river, jumping in from a foot or more above the water, or hanging by their hands from fringing Bamboos, and letting themselves drop. They swam round in all circles, only the head above water, never venturing far out, and with every sign of enjoyment.

The Malabar Squirrel (*Ratufa indica maxima*) was pleasantly common, as a rule in evergreen forest, but a few in purely deciduous areas.

The beautiful Stripe-necked Mongoose (*Herpestes vitticollis*) was also common, always alone, and always in marshy ground or near water. Its long chestnut fur shows up from some distance. It was very shy and wary, with extremely good powers of sight and hearing.

I was anxious to find the Pangolin (*Manis crassicaudata*) known in the hills as 'Ūdūmbū', and a familiar animal to the Kadars and forest guards, who described them as common, and sometimes caught by dogs, especially after the rains; but even the offer of a substantial reward failed to produce a specimen.

14, A. B. P. O,. C. R. STONOR,
INDIA. *Captain.*
March 10, 1944. *2nd Assam Regiment.*

[No exact data on the rate of growth in elephants is available. But some indication is provided in the note by Mr. Gordon Hundley (*Journ. B. N. H. S.*, Vol. xxxvii, No. 2, p. 487) which gives statistics of the rate of growth of calves, born in the stock of a timber trading company in Burma. At birth the average height of 109 male and 111 female calves was about 3 ft. high. No increase in height was registered in the first year. In the second year 8 male calves averaged 4′ 2″ : 5 females—3′ 11″. In the third year, 7 males averaged 4′ 5″. On this basis the 4′ 6″ calf observed by Captain Stonor must have been quite 3 years old. The period of gestation has been ascertained to be about 19 months, though it is said to vary from 18-22, as such impregnation for the second offspring must have taken place at least a year or so after the first calf was born. It is a common belief that most animals have well demarcated breeding seasons. Critical investigation has shown, that while there may be an annual period when breeding activity is more marked, a relatively large number of animals breed throughout the year—particularly in tropical countries. The frequent encounters between bull elephants referred to by the author are preliminaries to the establishment of lordship over the females. They occur as is shown, more commonly between the onset of the hot weather and the commencement of the rains—the period when breeding activity is more intense. —Eds.]

IX.—BEARDED BEE-EATER (*ALCEMEROPS ATHERTONI*) IN THE CENTRAL PROVINCES.

I sent you recently some notes on bird movements in the C.P. When on tour near Pachmarhi recently I saw a single specimen of the Bearded Bee-eater, *Alcemerops athertoni*. This is a new locality for the species. In Mr. Osmaston's list of Pachmarhi birds published in your Journal No. xxviii, 457 as far as I remember, he recorded hearing this bird but never saw it. It is not given in D'Abreu's list published in Vol. xxxviii.

HOSHANGABAD, C.P., C. HEWETSON.
April 8, 1944.

[Mr. Osmaston subsequently confirmed his original record by sight (p. 805 of the same volume). Messrs. Sálim Ali and H. Abdulali observed this bee-eater and Dauri (Hoshangabad Dist.) below Pachmarhi on 21-1-1942. Its occurrence in this area now seems well established—Eds.]

X.—A RECORD OF HODGSON'S FROGMOUTH (*BATRACHOSTOMUS JAVENSIS HODGSONI*) AND THE COCHIN-CHINA SPINETAIL *HIRUNDAPUS CAUDACUTUS* SSP. FROM NORTHERN BURMA.

While on active service recently in Burma I picked up (literally, for both were picked up dead) two interesting specimens which I skinned and carried in my pack for many days.

The specimen of Hodgson's Frogmouth was picked up on May 8, 1944 in the Katha district near the Kachin village of Lamai (Lat. 24° 53′, Long. 96° 03′) which is about 20 miles north-west of Mohnyin on the Burma railway. It was found at 2,000 feet on the path in bamboo jungle, with evergreen forest just below. The Kachins said it was called *Oo-koo* in Jinghpaw and *Kinbok* in Burmese, was fairly common, and its call was *po-chyi, po-chyi, po-chyi*, . . . , uttered rapidly; this information may not be reliable, and is given for what it is worth. The bird was in moult, and proved very difficult to skin. Previous records of Frogmouths from Burma are (writing from memory) from Mt. Victoria, Karenni, and the Dawnas, but not all of these three are Hodgson's species.

The Cochin-China Spinetail was floating down the Nampang stream (Lat. 25° 24′ Long. 96° 08′) in the Myitkyina district, about 6 miles south of Haungpa on the Uyu river; elevation 700 feet, date May 14, 1944. In measurement (wing c. 190 mm.) the specimen is intermediate between the measurements given in the *F.B.I.*, 2nd edition, for the race *nudipes* and the race *cochinchinensis*, and may prove to be an interesting connecting link. Again from memory, the only previous records of this species from Burma are those of J. K. Stanford from the east of the Myitkyina district.

SHILLONG. B. E. SMYTHIES,
May 29, 1944. *Burma Forest Service.*

[In his "Birds of Burma" Smythies records Hodgson's Frogmouth from Mt. Victoria and in Karenni. The former is ca. 21°N. x 94°E., the latter between 18-20°N. x 96-98°E.—Eds.]

XI.—NOTE ON THE NESTING OF THE HIMALAYAN SWIFTLET (*COLLOCALIA FUCIPHAGA*).

Rumours of pot holes over 1,000 feet deep took me to Buina Dhar above the ruined Buinathach Forest Rest-House in Chakrata District, U.P. Here just below the top of a knife-edge ridge was a fine open pot 110 feet deep and about 15 feet in diameter and close by on the other side of the ridge a small opening blocked by stones leading into a separate chamber with its floor 80 feet below the opening.

The open pot expands downwards and at the lower portion is about 60 feet long and 30 feet broad. From the bottom of the shaft a slope of fallen boulders leads down N.N.W. along the long axis of the pot. At the far end there is a small extension blocked a few feet in by a rockfall cemented with calcite. Very little light penetrates from the shaft opening and about fifty feet above the floor there is a gallery about four feet wide and here there is a small triangular window about two feet wide and five feet high leading into a second chamber. This second chamber continues in the N.N.W. direction and is about 40 feet long, 12 feet wide and about 40 feet high. The floor slopes downwards from the window, and from the far end one can turn back down a steep slope and descend through an awkward squeeze into a small lower chamber where there are some fine coloured calcite formations. Elsewhere there is very little calcite formation.

As the open pot is on the cool shady side of the hill a strong current of air passes down the shaft thence through the opening into the second chamber and up through the small opening on the sunny south-west side of the ridge.

Himalayan Swiftlets (*Collocalia fuciphaga*) fly down the open pot then through the window into the other chamber and nest there in great numbers. Only the faintest glimmer of light enters this chamber through this window and through the blocked opening above, so that the birds are practically in complete darkness. The window opening into the inner chamber must look like a black void through which they fly. Hence, when I had lighted candles in the inner chamber, and sat in the window, they seemed to mistake my silhouette for the opening and frequently hit me. So far at least they appear to depend on sight to find their way.

At the end of May the birds are in residence with nesting activities in all stages from no eggs,—one new-laid egg, two eggs under incubation,—to two half-fledged chicks. Only two eggs are laid and these are white, and ellipsoidal with only a slight narrowing at one end. The dimensions of the egg measured were length 20 mm., breadth 13.8 mm.

The nest is made of moss gummed in layers by means of the viscid saliva which is also used to stick the nest to the vertical rock wall, no use being made of rock ledges to support the nests.

The nest has an open cup about 2½ inches diameter and ¾ inch deep, below the cup is a slightly tapering pedestal about 2 inches thick. This pedestal perhaps represents growth of the nest, as a result of the cup at the top receiving a new layer each year. The rim of the cup is not horizontal but slopes down from the wall at about 30° or more from the horizontal. The side of the nest adhering to the wall projects upwards giving an increased bearing surface. The nest is not lined and no feathers are used.

Beyond a slight excitement and twittering when we first entered, the birds took little notice of us and continued their nesting activities undisturbed. In the middle of the day they came in large numbers and rested in clusters on the walls clinging in a vertical position, head upwards on to minute roughness of the wall. Later when climbing the ladder out of the cave one could pick an adult bird off a nest and put it back again without causing undue alarm.

When the cave was visited in the last week of October, no birds were present.

Nearly the whole floor of the inner chamber is covered with the regurgitated dejecta of undigested insect remains. This is a perfectly clean dark-brown material, devoid of smell; it cakes slightly when damp, but breaks up readily into a fine sand. The thickness of the layer of dejecta is about 2 feet, so there must be not less than 200 cubic feet of this material showing that the colony has occupied this cave for a very long period. The top layers of the dejecta are coarse, but it gets gradually finer as one gets lower. This fact and also the compaction with depth should be taken into account in any calculation of the time necessary for this accumulation. Below this there is an abrupt change to ordinary cave earth.

By the end of May there is a thin white crust of guano over this deposit, and there must be further accumulation during the summer, but by the end of October all of this has vanished. In May the inner chamber is very dry, and it is no doubt on account of this that it is chosen as a nesting place; in October the dampness is not markedly greater, but the fact that the guano vanishes, and that the predatory larvae of large beetles evidently find means of living in the cave suggest that during the rains the humidity is considerable. Insects are not common either in late May or late October, and I have not visited the cave during the rains. It would be interesting to do so. It is a speleological commonplace that caves when dry will often be found apparently entirely devoid of life, but the same cave under wetter conditions will be found with a teeming population, and I would expect this to be the case in this cave. During the dry period the fauna has hidden itself away in inaccessible crevices.

A cave of this nature is certain to have an entirely different type of fauna to that in caves without an organic deposit; it is therefore not surprising that none of the insects, or myriapods found here are to be found in the extensive caves further to the west in the Chakrata forest division, where there are no Swifts. Only the spiders may be the same.

In Swiftlet Pot the following has been found:—

Coleoptera: A carabid beetle (*Sphodropsis cnesipus* (Andr.)).
  A staphyline beetle.
  Another beetle was seen, probably *Cryptophagus* sp. but it escaped into a crevice.
Microlepidoptera: A small buff-winged moth, not flying to light, common.
Collembola: One species, very few seen.
Myriopoda: One species, several found, always deep down at the junction between the dejecta layer and the cave earth.
Arachnida: One species.

Old adults of the carabid beetle were found in May on the surface of the deposit, but in October a very recently emerged specimen was found about six inches down in the layer of dejecta. I think there is no doubt that the immature stages of this beetle were spent in the cave.

On my first visit I was unaccompanied, and on this occasion only descended the 110-foot pot, and failed to observe the window into the inner chamber since this was hidden from below by the ledge. In October 1942, with R. D. Leakey the inner chamber was entered, and again in May 1943 when I was accompanied by E. J. Douglas. Both are members of the British Speleological Association and experienced Yorkshire pot-holers. On this latter occasion a goat-herd guided us to two open holes in the wooded hill slopes about half a mile away. A stone thrown down seemed to take between 4 and 5 seconds before hitting the bottom with a dull thud. All my rope ladders were tied together making a total of 152 feet, the last 30 feet being very old and flimsy. Down this Douglas climbed and at the very foot of the ladder found himself hanging in space far out of sight of the bottom, which must have been at least 100 feet further down, and so up again—hard work at nearly 9,000 feet above sea level.

All this time swiftlets were diving down straight out of the sunlight into the black shaft and going down in steep spirals in pitch darkness to their nests 300 feet or so below ground. Nests started 50 feet down, but the majority were far below the bottom of the ladder. These two open pots are about 50 yards apart and are almost certainly connected below perhaps by some great cavern.

Here then is an interesting piece of exploration yet to be done, but not one to be undertaken without careful planning and with a strong party.

The situation of these caves is as follows:—

Chakrata District, U.P.
Chakrata Forest Division.
Bawar Range, Kudog Reserved Forest.

Swiftlet Pot. Lat. 30° 45′ 20″; long. 78° 00′ 35″; height 8,525 feet on Biuna Dhar. It is about 20 yards north of the path where it crosses the ridge.

Swift Holes. Lat. 30° 45′ 11″; long. 78° 00′ 18″; height 8,550 feet. They are little below on the north side of the ridge about 200 yards north-west of point 8837 amongst trees.

The following Survey of India maps should be consulted:—

½ inch to 1 mile map 53 J/NW; Forest map 4 inches to 1 mile 53 J/1 S.2.

Water is scarce and is only to be obtained from below the Buinathach F.R.H. or on the way to Kudog F.R.H.

Accompanied by H. J. Larwood, I revisited the Biunathach area in May 1944. The year was a late one and there were still a few drifts of snow at 9,000 feet on the Mandali road beyond Deoban on 7th May. Descending Swiftlet Pot on 9th May, we found all the nests with two eggs apiece, but the birds were not yet sitting and there were no chicks. The temperature in the upper chamber was 48° F. One bird was secured and sent to the Society enabling the previous identification to be confirmed. No ecto-parasites were found on it.

At the place where I had delved two feet into the insect dejecta and had disturbed the cave earth below, some bacterial activity had been released. A buried stone was found covered with white slime, and the dejecta from a few inches below the surface had been transformed into a smooth black viscous mess apparently extending to the bottom. Elsewhere the dejecta was unchanged and as previously described. This bacterial action is a new phase, and if it extends over the whole mass of dejecta, conditions in the cave will be profoundly altered.

On 10th May, with Larwood at the top supervising the life-line, I descended the lower of the two Swift Holes, which had been abandoned the previous year owing to shortage of tackle. The bottom was reached at the end of a 243 feet pitch, the rope-ladder hanging clear of the rock all the way down. At the bottom is a hall 18 feet wide and 50 feet long, 30 feet high at the lowest part.

The entry shaft is situated close to the lowest end of the hall and here, looking upwards, daylight can be dimly seen. The hall slopes upwards rising about ten feet to the further end; here an aven evidently leads to the Upper Swift Hole, but it is now blocked. At some time there has been a great fall of clean angular limestone chips usually less than six inches long. This seems to point to very insecure conditions in the upper cave. The fall of stone has blocked what may be a passage extension leading out of the hall at the aven end. At this end too but on the opposite side, a narrow fissure goes on, too small to penetrate. Down this also some small limestone chips had flowed. Looking along this fissure, as far as one could see the lefthand wall was coated with a polished calcite layer coloured, to a height of five feet or so, a livid blood red, perfectly uniform in hue and very startling in appearance. I have never seen anything to equal this.

Conditions in the hall were damper than in Swiftlet Pot. There were several large mounds of insect dejecta with the normal sandy consistency. The temperature in the hall was 48½° F. Nests started fifty feet down the shaft and continued to the bottom and in the hall itself, always located at the dryest and most sheltered parts. Only one or two nests had two eggs, all the rest had one egg only on this date. Both in this cave and in Swiftlet Pot the nests are always separate, usually a foot or more apart and never in clusters.

Attempts to raise the rope ladders failed. They had jammed somewhere. Probably the surplus fifty feet at the bottom got into a tangle. Finally the ropes were cut and the ladders dropped down.

CECIL HOTEL, DELHI. E. A. GLENNIE.
November 5, 1943. *Col.*

XII. THE MYSTERY OF BIRD-'ANTING' (REPRODUCED FROM *COUNTRY LIFE*—NOVEMBER 5, 1943).

One of the minor ornithological mysteries is why birds use ants as part of their toilet. Whatever the explanation may be, the habit has been attested too often by various observers in several countries for there to be any doubt about its occurrence.

Charles K. Nichols, writing in the American bird journal *Auk*, says he saw on his lawn an American robin, which is similar to a British thrush, going through some remarkable actions. The bird picked up something from the ground and then quickly placed it under one of its partly opened wings and sometimes on the underside of its tail. Frequently the bird lost its balance and fell on its back. In addition to these actions it sometimes pressed its breast to the grass and partly rotated its body with the breast as pivot.

Later another robin appeared on the scene, drove the first one away and after settling on the same spot on the lawn went through similar actions. The second robin was in turn replaced by a third which occupied the favoured spot for a few minutes. Thereafter the birds took 'turn and turn about'. When Nichols examined the spot, while the birds were momentarily frightened away he found a swarm of about 100 ants milling excitedly about a space a foot or so square.

The next observation concerns two tame jays which used to fly about a farm. Whenever an ants' nest was laid bare in the course of the farm work the two birds trod on it, and this stimulated the ants to shower the birds' feathers with their acid ejections. Sometimes the jays wallowed in the nest. They often raised their tails and sat down and then almost immediately turned on their shoulders. The jays stayed on the nest for periods up to a quarter of an hour. They then flew away and shook and preened themselves as after a water bath.

One other field observation may be given. Josselyn Van Tyne prefaces the following record of what he saw by the statement: 'I never fully believed in the occurrence of this most improbable phenomenon (bird 'anting') until I recently saw it with my own eyes.'

Soon after sunset one evening in July, he writes, he saw a male American robin preening itself on the lawn 15 feet from his window. 'The bird was preening much more vigorously than is customary and his actions were further remarkable for the frequency with which he preened in a single motion the whole outer edge of the wing from wrist to tip. In fact, this wing preening was done so violently that the bird repeatedly fell down at the end of the preening motion, and once this ended in a complete somersault.

'Sometimes the bird preened the tail or body plumage, but more often he concerned himself with the wing. Almost immediately I noticed that nearly every preening was preceded by a hasty picking of some small object from the ground, and I realised that here at last was a bird "anting". Several times the robin crouched and seemed to rub its body against the ground.'

To these and the many other existing records of observations on anting there has recently been added a complete account of the habit witnesed under controlled conditions. H. R. Ivor scattered some earth, containing several hundred ants, over a part of the floor of his aviary and then he lay down on the ground close to the birds to watch their reactions. Some of the birds actually anted on his hand. Sixteen experiments were carried out altogether and 20 out of the 31 species of birds in the aviary were observed 'to ant.' About a score of other species have been reported by other observers to ant.

Ivor says: 'The moment an ant was sighted by any bird which anted, there seemed to be an instantaneous and instinctive reaction. The ant was picked up and held in the tip of the bill; the eyes were partly closed; the wing was held out from the body but only partly spread; the wrist was drawn forward and raised, thus bringing the tips of the primaries far forward and touching the ground; the tail was always brought forward and under to some extent, on the same side as the extended wing, and often so far that the feet were placed upon it. Stepping on the tail at times caused the bird to fall on its side or even on its back.'

The bird seizing the ant rubbed it swiftly only on the ventral surface of the primary wing feathers. After being used for anting the ant was often, though not invariably, eaten.

Enthusiasm for anting varied with the season, the favourite period being between April and July. Ivor adds: 'During the height of the anting season the act of anting seemed to engender a state of ecstasy so overwhelming that even domination and enmity were forgotten . . . . . at times from twenty to thirty birds would be going through the performance at one time on a space of four of five square feet, where they were continually bumping against one another.'

Confirmation of Ivor's belief that anting is instinctive is found in the reactions of young birds when confronted with ants. Young starlings, taken from the nest and given some ants, dressed their plumage just as in the case of adult birds. A young dipper when first presented with some ants, seized one after another in its beak and passed them through its feathers.

Why do birds ant themselves? Various theories have been propounded. One suggestion is that the bird is stimulated by the crawling of the insects, their tiny bites and acrid secretions. The pleasure may be akin to that derived from the ruffling of a bird's feathers by a human hand.

Another suggestion is that birds resort to anting to rid themselves of parasites. The formic acid secreted by ants has antiseptic properties. Birds have been seen to hold ants in a way that would indicate that the bird was trying to make the ants spray their acid on the feathers. Incidentally, a tame jay has been known to intercept the spurting sap from an orange that was being peeled. The bird went through the motions of bathing at the same time. This behaviour occurred more than once.

One observer says he has seen ants seize the parasites on a crow which was anting and bear them away. In this connection it is interesting to learn that in some parts of the world ants are sometimes used to remove vermin from clothes. The infected garments are placed on large ant-hills and, when collected, they are found to be freed from vermin.

One other apparent use of anting was mentioned long ago by Audubon. He says young Eastern turkeys 'roll themselves in deserted ants' nests to clear their growing feathers of the loose scales and prevent ticks and other vermin from attacking them, these insects being unable to bear the odour of the earth in which ants have been.'

FRANK LANE

[The subject of Birds 'anting' themselves was first raised in the *Journal* by Mr. B. B. Osmaston. (*Journ. B.N.H.S.*, Vol. XIX, p. 752) In a later issue (Vol. XXXIII, No. 4, Mr. Salim Ali published a number of recorded instances and gave the various theories offered in explanation of the curious habit. Further notes appeared in Vol. XXXIX, No. 1, p. 182 (B. B. Osmaston) and p. 640 (T. Bainbridge Fletcher); Vol. XLII, p. 935 (N. G. Pillai).—EDS.]

XIII—EGG-LAYING PERIOD OF THE COMMON INDIAN MONITOR.

Having read Mr. Charles McCann's remarks on the appearance of the young of *Varanus monitor* (L.) in this *Journal*, Vol. XLII, No. 1 dated December, 1940, I record the following incident of eggs having been laid at an apparently unusually early period.

At the end of October, 1942, a friend of mine captured an adult specimen of this reptile on Elephanta Island, Bombay. After examination I found that it was a gravid female and decided to take it back to my room for further observation; it was placed in a sack, therefore, and so transported back by launch to Colaba on the 1st November. On removing it from the sack, I was surprised to find that one egg had already been laid during the short journey. After this it was given the freedom of my room and appeared to make itself quite at home, as it entered a drawer in the dressing-table and deposited some more eggs amongst my clothes! This was on the 2nd November when three eggs were laid, followed on the 3rd by the fifth egg. The following day, unfortunately, the monitor had to be returned to Elephanta Island owing to circumstances which prevented me keeping it for further observations. At the time it was returned, however, another seven eggs could be distinctly felt through the skin on either side of the belly, thus making a total of twelve eggs in all.

The specimen referred was 3 feet 5 inches long, the tail accounting for 2 feet of this.

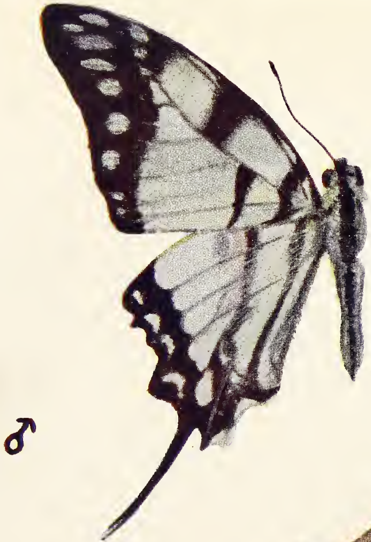
ORDNANCE DEPOT, J. D. ROMER,
BOMBAY, *Sergeant.*
February 27th, 1944.

XIV.—A GOOD METHOD OF WEIGHING FISH WHICH ARE TOO HEAVY FOR A SPRING BALANCE.

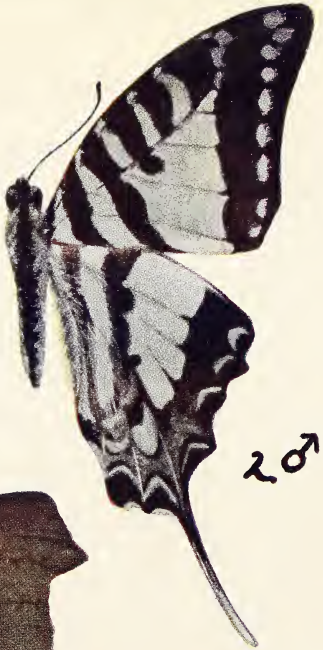
(*With a text-figure.*)

In the Miscellaneous Note No. XIII in *Journal* No. 4, Vol. XLIII on 'Record Mahseer' by Col. R. W. Burton, I notice that two of these big fish had to be halved in order to weigh them. This prompts me to remind your members of the 'Principle of Moments'.

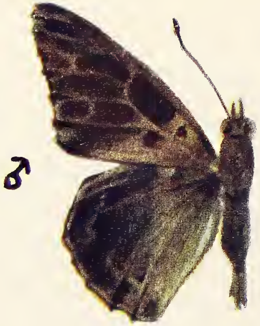
All that is required for this method is a long, strong stick (of fairly even cross section) and a measure. Hanging the fish on one



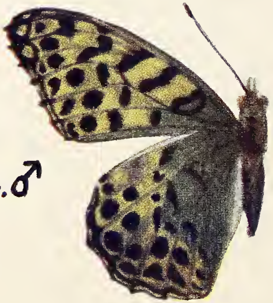
1. ♂



2 ♂



3. ♂



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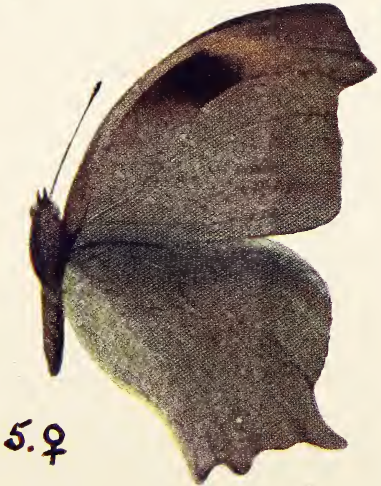
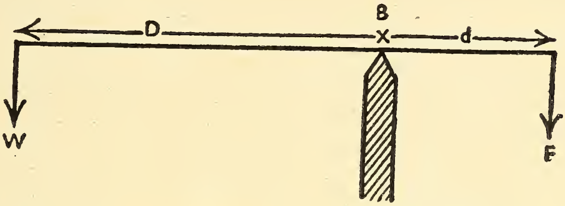


5. ♀

F. Mathews.

1. *Pathysa nomius*, Esp. (Aberration). 3. *Argynnis lathonia issoca*, Db. (Melanism).
2. (Typical) 4.

end and a known weight on the other, balance the stick on any convenient object, thus:—



Let B be the point of balance.
" F be the fish.
" W be the known weight.
Measure 'D' and 'd'.
Then $W \times D = F \times d$.

e.g., If $W = 56$ lbs.
$D = 39$ inches.
$d = 21$ "
then $56 \times 39 = F \times 21$

$$F = \frac{56 \times 39}{21} = 104 \text{ lbs.}$$

EDINBURGH. A. P. MILLARD.

XV.—SOME INTERESTING BUTTERFLIES.

(*With a coloured plate.*)

1 **Pathysa nomius nomius**, Esperance. ♂ Aberrant (fig. 1.)

Caught at Kallar, Nilgiris, on 19-2-1942 at 1,350′ after a period of normal weather. Expanse: 76 mm.

The main characteristics of this remarkable aberration are as follows: On the forewing, in the cell, bands 2 and 4 are entirely absent; on the upperside there is no spot below band 3, though it is present on the underside. The submarginal spots are enlarged.

On the hindwing, the two bands are narrow, the tornal grey area is absent, and the arrangements of spots and lunules there is unusual.

2. **Pathysa nomius nomius**, Esperance. ♂ Normal (fig. 2.)

Caught at Kallar, Nilgiris, on 20-5-1941 at 1,350′. Given for comparison. Expanse: 80 mm.

3. **Argynnis lathonia issoea**, Doubleday. ♂ Melanistic (fig. 3.)

Caught at Narkanda, Simla Hills, on 19-6-1940 at 9,000′ after a period of normal weather. Expanse: 56 mm.

This specimen seems to be a melanism, an unusual type of aberration among butterflies. The main characteristics are as follows: The whole upperside is of a deep blackish brown, overlaid with golden-brown scales in the basal area and in places along the veins.

Most of the discal area of the under forewing is deep brown but the basal area and along the veins is yellowish. On the under hindwing the lines and patches between the silver spots are blackish-brown and some of the spots are modified. The two large interior spots in 7 are joined.

4. **Argynnis lathonia issoea**, Doubleday. ♂ Typical (fig. 4.)

Caught at Simla in April at 6,500′. Given for comparison. Expanse: 60 mm.

5. **Melanitis phedima varaha**, More. ♀ Aberran? (fig 5.)[1]

Caught at Kallar, Nilgiris, on 14-8-1942 at 1,350′. Expanse: 82 mm.

---

[1] Further similar specimens since caught point to the possibility of this being a variety of *Zitenius*.

I have been unable to find any satisfactory description of the female of *Phedima varaha*. As this specimen seems to be so different from other *Melanitis* females, I suspect that it is an aberration, but even if it is typical I feel that a description will be useful.

Phedima varaha is rare in the Southern Nilgiris and this is the only female I have caught; consequently, I have no local specimens with which to compare it. I have, however, caught three males and these all answer to Evans' description of that sex.

This female was caught in the middle of August and may be safely assumed to be a W.S.F. Nevertheless the underside is not ocellated, there being only vestigial white spots. The background of both underwings is of a bright ochreous colour with well-marked discal lines.

On the upper forewing there is a well-defined black mark at the end of the cell and beyond it. The costa is ferruginous-ashy, broadening to a brighter ferruginous patch beyond the black mark, which shades into an ill-defined lighter-brown area that reaches the termen. There are no traces of black and white spots in 3 and 4.

Evans gives the measurements of this race as 60 to 70 mm: my four specimens vary from 78 to 82 mm. Kallar, however, from which place three of these come, specialises in 'giants'.

6. **Terias hecabe simaluta.** More ♂ Albinistic (No fig.).

Caught at Kallar, Nilgiris, on 1-3-1942 at 1,350′. Expanse: 39 mm.

In this specimen all the marginal markings are of a very deep brown, not black, and the disc of both wings is white, very faintly tinged with greenish yellow.

Melanisms and albinisms are easily explained by excess, or lack, of pigmentation. But what are the causes behind such a remarkable sport as No. 1? It would be interesting to have information about any theories that have been advanced to explain such aberrations.

Is No. 1 a new species in the making?

All the figures shown are slightly enlarged.

KETTI (NILGIRIS). M. A. WYNTER-BLYTH, M.A. (*Cantab.*).

XVI.—A NEW VARIETY OF PAPAYA: *CARICA PAPAYA* VAR *FLAVA* FROM TRAVANCORE.

(*With 3 text-figures.*)

In connection with a study of the different sex types of *Carica papaya* we have collected more than one hundred samples of seeds of various varieties of papaya from the different tropical and sub-tropical countries where it is cultivated. Plants have been raised from sixty of these varieties and they are all growing very well (in the Economic Botanist's area in the Agricultural College, Poona), in spite of the great change of climate to which some of them have been subjected. In papaya, classification into varieties have been done on a purely arbitrary basis, so much so, that the same variety is known under different names in different places. However, there are quite unmistakable varieties like the 'Solo papaya', the 'Melon papaya', the 'Washington papaya,' and a few others. Observations made on a large number of 'varieties' show no marked differences among them. The only differences are in size and shape of fruits, slight variations in size of the plants, and variation in flavour of the fruit. These differences between varieties, however, are not greater than what have been observed within the same variety. Only the sample of seeds, received from Travancore, gave rise to plants of uniform habit and character, distinctly different from any other variety in our collections. Reference to available literature shows that this type has not been described previously. The basis on which species classification has been made in *Carica* by Heilborn (1936) would permit this new variety being taken as a distinct species. Till more is known about the taxonomy of the whole genus, we feel, it would be better to assign it only the rank of a distinct variety.

Carica papaya var. *travancorica*:

The plant has an unbranched erect stem, 10-15 feet high, straight and cylindric with numerous leaf-scars arranged in an ascending spiral. The whole plant is yellowish in colour and is thus markedly different from other varieties.

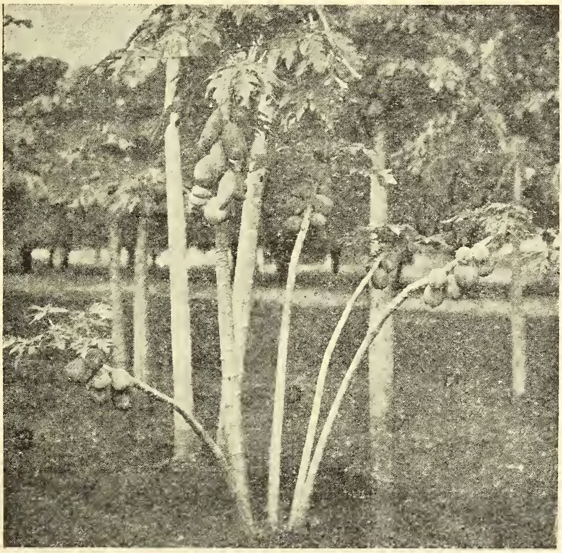


Fig. 1.—Plants of *Carica papaya* var. *travancorica*.

Stem is yellowish, with brown patches. Leaf-scars are whitish with brown tinge. The leaves are very crowded at the apex and give the plant a semi-circular contour at the top. Leaves yellowish green, leaf-stalk yellow, base of leaf with overlapping lobes; lobes 7 to 10 and as many as main veins, which are of a lighter yellow than the blade.

Plants female or hermaphrodite; males absent.

Female.—Flowers in simple or modified cymose inflorescence (usually 3 flowers in one) in the axils of leaves. Terminal flowers only functional; 4-6 cms. long, 3-4 cms. across, stalk short and thick. Calyx with prominent yellow lobes, pointed, 0.5-1 cm. long, and alternating with petals. Petals yellowish white, 5-6 cms. long, 1-1.5 cm. broad, contorted, lower part boat-shaped, upper linear with rounded apex, glabrous. Ovary large, 3-4 cms. long, 2-2.5 cms. broad, deep yellow, glabrous, very indistinctly five-grooved, each carpel opposite a petal, syncarpous, one celled, with parietal placentation and many ovules. Stigma distinctly five branched, 1-1.5 cm. thick, reddish, with good flavour. Seeds not so numerous as in the green papaya. Seeds 0.5 cm. long, 0.3 cm. broad, ovate, light brown colour enclosed in a transparent gelatinous aril. Size of fruit varies from 10-15 cms. long, by 8-12 cms. broad; nearly spherical.

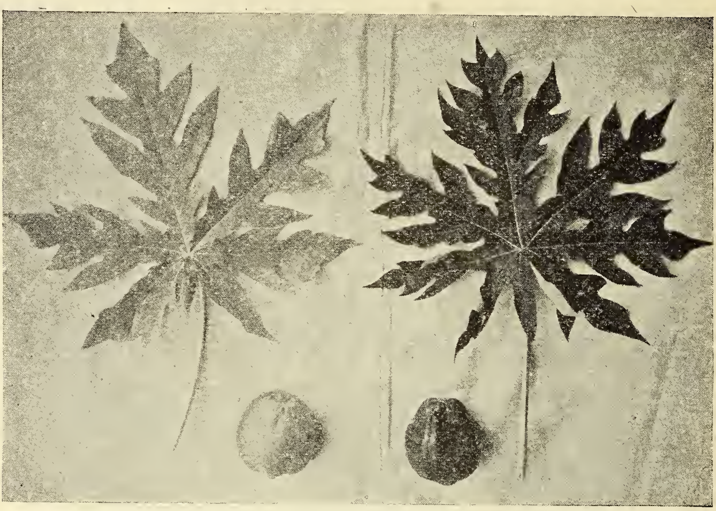


Fig. 2.—Leaf and fruit of the yellow *Carica p.* var. *travancorica* (left) and normal green variety (right).

Hermaphrodite.—Flowers similar to female in size and colour of parts, varying number of small stamens from 5 to 10 present. Sometimes filaments adhere to carpels and not infrequently one or two of the fine carpels may be free at the upper region. Fruit shape pyriform, slightly distorted and distinctly five-grooved. Flavour as good as the fruits from the female. Both sex types bear a large number of fruits from as low as one foot from the ground under Poona conditions, though in Tranvancore the more humid climate promotes greater vegetative growth and fruits appear only higher up the plant.

Notes.—This is a very distinct type from the ordinary green papaya. The junior author has observed these plants for a number of years in Travancore, but not elsewhere. Probably it grows in other parts of the West Coast also. Nothing is known about its origin or history. No male plants have been ever seen in Travancore and in our plantation here with forty plants of this variety, there is an approximately equal proportion of females and hermaphrodites, but not a single male plant. This would show that it is a fixed variety distinct from others. In this connection it is interesting to note that Heilborn (1921), during his travels in South America, noted the absence of male plants in certain species of *Carica*,—*C. chrysopetala* and *C. pentagona*, both of which have parthenocarpic fruits. He also mentions that Jameson (1865) described two cultivated species of *Carica*, in which he failed to find any male individuals. Apart from the distinct morphological differences, it is also noted that the latex content of the Travancore papaya is much less.

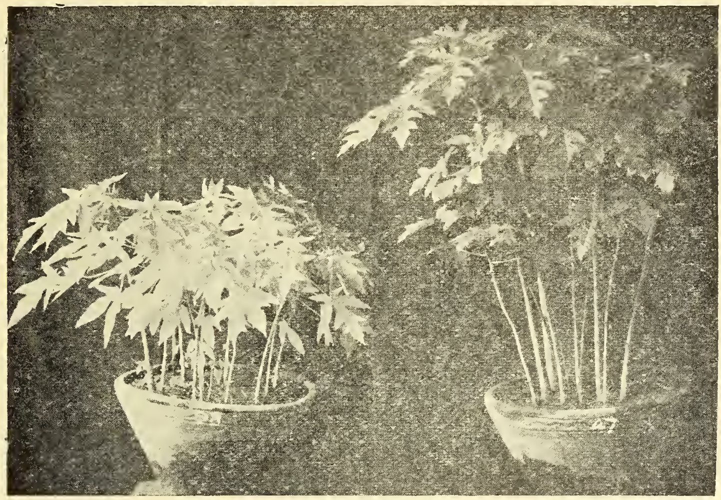


Fig. 3.—Seedlings of yellow papaya *Carica p.* var. *travancorica* (left) and normal green papaya (right).

Genetical studies on this variety have been started with a view to finding the cause of absence of males in this variety and also to study the inheritance of the yellow colour.

Due to its attractive appearance and almost 'bushy' growth, this variety should prove to be of great horticultural interest.

The authors are indebted to Mr. A. T. Abraham of Travancore for kindly supplying the seeds of the variety described above.

College of Agriculture,
Poona,
10*th March*, 1944.

L. S. S. KUMAR,
A. ABRAHAM.

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XVII.—THE FLOWERING OF *STROBILANTHES*.

In a recent note in this Journal, Mr. C. McCann invited the help of readers interested in Botany for fixing the date of flowering of the various species of *Strobilanthes*. It may be of interest to jot down a few notes on three different species which have been observed in flower during recent years.

1. *Strobilanthes callosus*, Nees. This plant is very common on the slopes and tops of Echo Point and Bhoma Hills in Khandala; it is also pretty common in the ravines among the undergrowth of certain

parts of the forest. Generally, however, it favours an open situation, and with its dense foliage shades every other plant out of existence. The first time this plant was observed in flower was in September 1942; flowering was then very sporadic, as only a few shrubs came into flower from the many plants forming the large Strobilanthes clumps. The following year during the months of August-October there was a veritable riot of flowers; buds appeared in June, and at that time the hillsides seemed covered with a pinkish hue due to the colour of the bracts; shortly afterwards, with the opening of the flower, the colour scheme changed to a rich cobalt blue. This plant usually grows to a height of about 8 feet about Khandala, occasionally it reaches 15 feet in height; but even when the plant was only 18 inches high, the whole plant was a mass of cobalt blue flowers. By December 1943 all the flowers had disappeared, and the plant was then densely covered with glandular hairs with a strong, persistent and rather pleasant odour. At the beginning of the rains in 1944, the ground seemed to be covered with the seeds of *Strobilanthes*; when passing near a clump of such plants, one could often hear a series of slight 'explosions' caused by the bursting of the fruits and observe the seeds being scattered in all directions to a distance of several feet from the plant.

2. *Strobilanthes ixiocephalus*, Benth. This plant was first noticed in flower in March 1942; the flowers, when newly opened, are of a pale sky blue colour, but as they advance in age, they turn very pale lilac or practically white. All through the second half of 1943, and up to May 1944 the plant has been in full bloom. In contrast to *S. callosus*, this species is to be found only in dense, shady forests, and though of a somewhat gregarious habit, it grows either solitary or more often in small clumps. The scent of the oil from the glandular hairs covering the fruit is strong and unpleasant, not very different from that of *Pogostemon parviflorus*.

3. *Strobilanthes perfoliatus*, Anders. For the last four years we have been watching a plant, which from its general habit and appearance seemed to be one of the Acanthaceae. Flowers were seen and collected for the first time on November 5th, 1943; towards the end of December 1943 flowering was at its height; by the end of March of this year, there was only an occasional flower to be seen. *S. perfoliatus* is not so conspicuous in colour which is light violet, or size of its flowers, as by the numerous glandular hairs covering the whole of the inflorescence, even whilst the plant is in flower; when such hairs were pressed or merely stroked with the hand, a very strong and sweet scent was obtained which was strongly reminiscent of that of Juniper. *S. perfoliatus* grows in open situations, in clumps of 12-15 feet in diameter. Wherever the plant was seen especially in the fruiting stage, there were large numbers of insects hovering about and feeding on its fruit; and this may account for the relative scarcity of the plant in Khandala and elsewhere.

ST. XAVIER'S COLLEGE,
BOMBAY.
4th July 1944.

H. SANTAPAU, S.J.

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